

TRAFFIC IMPACT ANALYSIS

HUDDLE
LAKE COUNTY, FLORIDA



Prepared for:

CynerGreen Development
137 North Highland Street
Mount Dora, Florida 32757

Prepared by:

Traffic Planning and Design, Inc.
535 Versailles Drive
Maitland, Florida 32751
407-628-9955

May 2023

TPD № 5802

PROFESSIONAL ENGINEERING CERTIFICATION

I hereby certify that I am a Professional Engineer properly registered in the State of Florida practicing with Traffic Planning & Design, Inc., a corporation authorized to operate as an engineering business, EB-3702, by the State of Florida Department of Professional Regulation, Board of Professional Engineers, and that I have prepared or approved the evaluations, findings, opinions, conclusions, or technical advice attached hereto for:

PROJECT: Huddle
LOCATION: Lake County, Florida
CLIENT: CynerGreen Development

I hereby acknowledge that the procedures and references used to develop the results contained in these computations are standard to the professional practice of Transportation Engineering as applied through professional judgment and experience.

NAME: Turgut Dervish, P.E.
P.E. No: 20400
DATE: May 26, 2023
SIGNATURE: _____

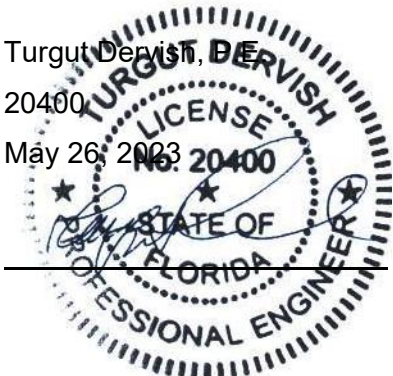


TABLE OF CONTENTS

	Page
INTRODUCTION	1
EXISTING CONDITIONS ANALYSIS	4
Roadway Segment Analysis	
Intersection Analysis	
PROPOSED DEVELOPMENT AND TRIP GENERATION	7
Trip Generation	
Trip Distribution/Trip Assignment	
PROJECTED TRAFFIC CONDITIONS	9
Background Traffic Projections	
Roadway Segment Analysis	
Intersection Analysis	
Turn Lane Analysis	
STUDY CONCLUSIONS	13
APPENDICES	14
A Study Methodology and Related Correspondence	
B Intersection Traffic Counts/FDOT Seasonal Factors/Signal Timings	
C Existing HCS Capacity Analysis Sheets	
D Projected HCS Capacity Analysis Worksheets	
E Turn Lane Referenced Data	

TABLE OF CONTENTS, continued

LIST OF TABLES

	Page
Table 1 Existing P.M. Peak Hour Roadway Capacity Analysis.....	4
Table 2 Existing Intersection Capacity Analysis	5
Table 3 Trip Generation Calculation Summary	7
Table 4 Projected P.M. Peak Hour Roadway Analysis	9
Table 5 Projected Intersection Capacity Analysis.....	10

LIST OF FIGURES

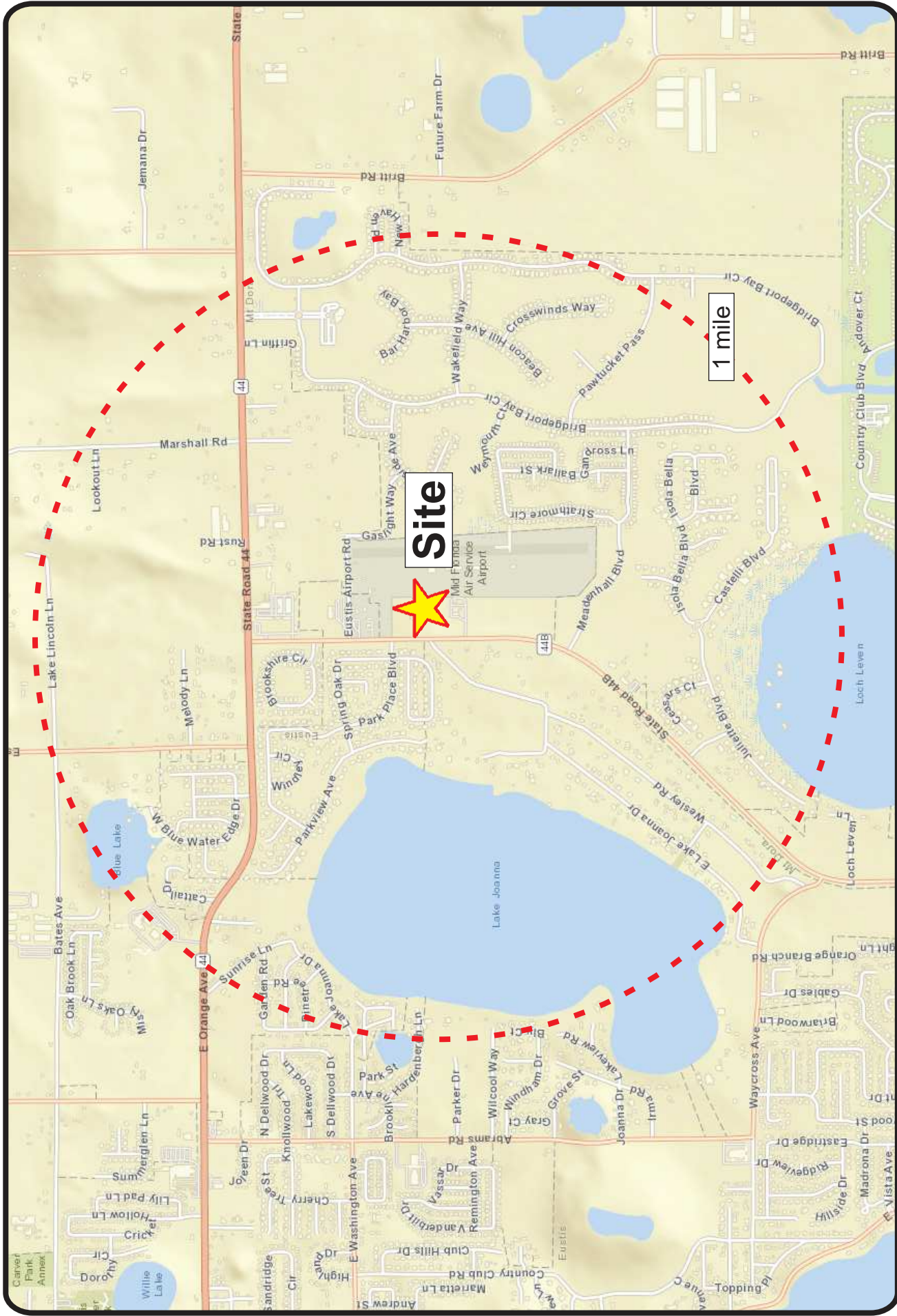
Figure 1 Site Location	2
Figure 2 Site Plan	3
Figure 3 Existing P.M. Peak Hour Traffic Volumes.....	6
Figure 4 Project Trip Distribution/Assignment.....	8
Figure 5 Projected P.M. Traffic Volumes	11

INTRODUCTION

This analysis was undertaken in order to assess the traffic impact of Huddle, a mixed-use development in Lake County. The proposed development will consist of 40 townhomes and an 8,793 square foot restaurant located on the east side of SR 44 opposite Lake Joanna Drive. It is anticipated that the project will be completed by the end of 2025. Access to the site will be provided via a full access driveway on SR 44. **Figure 1** depicts the site location and **Figure 2** the site plan and its access configuration.

As per the Lake Sumter MPO Traffic Impact Study Methodology and Guidelines, the study will be for a Tier 1 TIS with a minimum of one mile impact area. The analysis was conducted in accordance with a traffic study methodology submitted to and reviewed by the County. This methodology and related correspondence are included in **Appendix A**. Data utilized in this study consisted of a site plan provided by the Project Engineers, traffic volume data obtained from the most recent Lake County Annual Counts and Level of Service Standards from the Lake County 2022 CMP Database. Intersection turning movement counts were collected by Traffic Planning and Design, Inc. staff.





Site Location

Huddle - Lake County
 Project No 5802
 Figure 1



EXISTING CONDITIONS ANALYSIS

The existing conditions analysis includes classified roadways within the identified one-mile study area. At the request of the County, a segment of SR 44 outside of the one-mile impact area was included in the analysis along with the following intersections:

- SR 44 and Orange Avenue
- SR 44 and Lake Joanna Drive
- SR 44 and US 441
- SR 44 and Waycross Avenue
- Estes Road and Orange Avenue

The study roadways and intersections were analyzed for the P.M. peak hour.

Roadway Segment Analysis

The roadways were analyzed by comparing the existing traffic volume of each roadway segment with the corresponding adopted LOS/capacity value for the P.M. peak hour. The existing traffic volumes and the adopted capacities for the roadway segments were obtained from the Lake County 2022 CMP database. The existing P.M. peak hour roadway capacity analysis is summarized in **Table 1**. As shown, the existing conditions analysis of P.M. peak hour traffic conditions reveals that the study roadway segments currently operate satisfactorily at or above their adopted Level of Service capacities except for SR 44 from US 441 to Waycross Avenue which is failing with LOS F.

**Table 1
Existing P.M. Peak Hour Roadway Capacity Analysis**

Seg. ID	Roadway Segment	Lns	Road Type	LOS Standard	Pk Hr Direction Capacity	Direction	Volume	V/C	LOS
SR 44									
3262	US 441 to Waycross Ave	2	Urban Divided	D	970	NB	1,235	1.27	F
3268	Waycross Ave to Orange Ave	2	Urban Undivided	D	920	NB	907	0.99	D
3270	Abrams Rd to Thrill Hill Rd	2	Urban Undivided	D	920	EB	706	0.77	C
Estes Road									
1850	Lake Lincoln Ln to SR 44	2	Urban Undivided	D	840	NB	262	0.31	C



Intersection Analysis

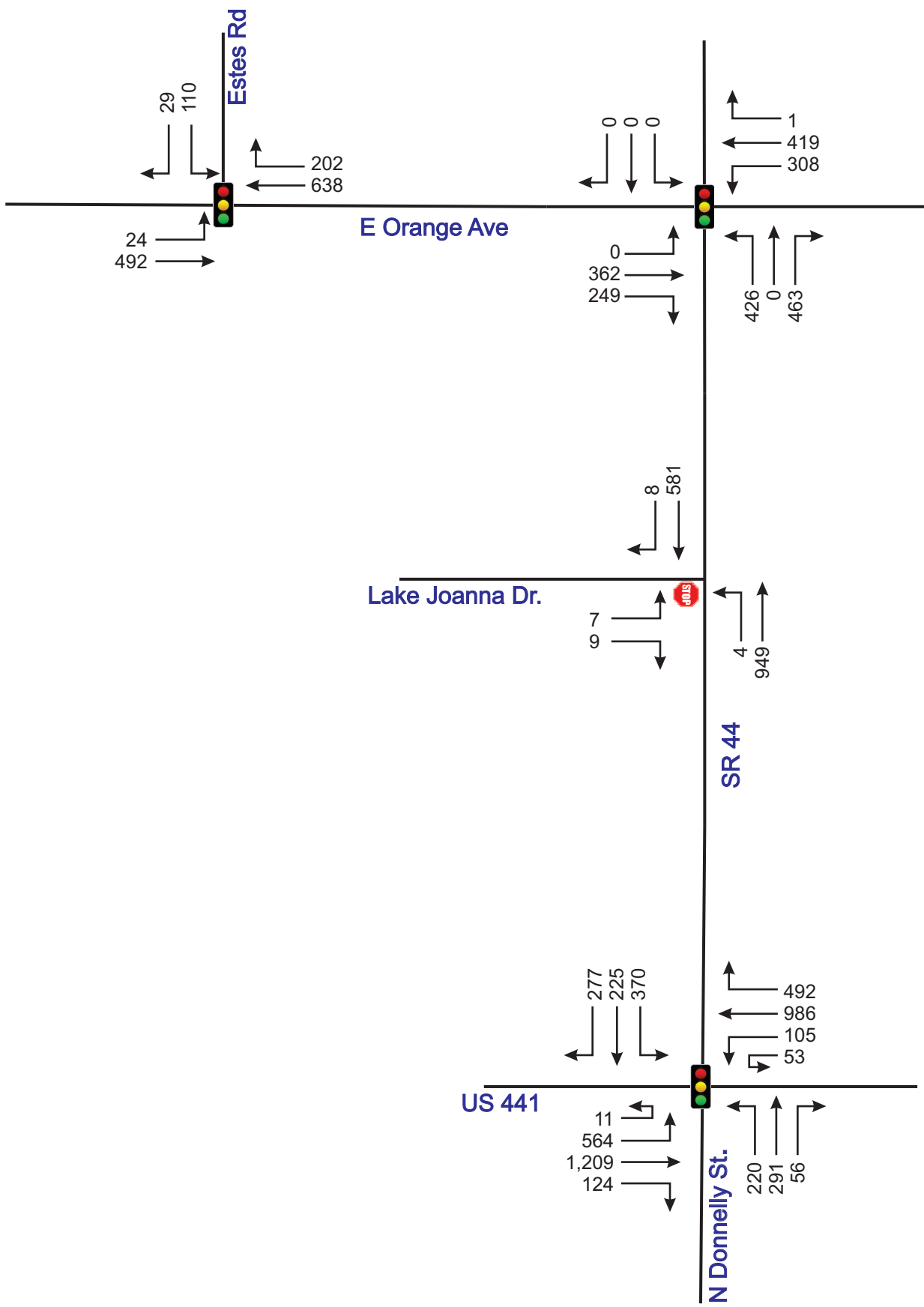
The study intersections were analyzed in accordance with the procedures of the *Highway Capacity Manual (HCM)* and Highway Capacity Software. In the analysis, existing P.M. peak hour traffic volumes, intersection geometry and traffic controls were used. The intersection counts were made in May 2023 during a week when the FDOT seasonal factor for Lake County was less than 1.00. Therefore, the counts were not seasonally adjusted.

The intersection P.M. peak hour counts are depicted in **Figure 3**. Detailed intersection traffic count data and seasonal factor information along with signal timings are included in **Appendix B**. The results of the intersection capacity analysis are summarized in **Table 2**. This table shows that the intersection of SR 44 and US 441 is currently failing due to the high existing volume on US 441. This is due to the high volume of vehicles turning from US 441 to travel north on SR 44. Other study intersections are currently operating at overall satisfactory Levels of Service. The HCS capacity analysis worksheets are included in **Appendix C**.

**Table 2
Existing Intersection Capacity Analysis**

Intersection	Control	EB		WB		NB		SB		Overall	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
SR 44 & Orange Ave	Signal	30.8	C	16.8	B	36.8	D	0.0	A	28.7	C
SR 44 & Lake Joanna Dr	Stop	30.1	D	--	--	0.2	A	--	--	--	--
SR 44 & US 441	Signal	660.3	F	622.9	F	49.6	D	46.7	D	471.1	F
Estes Rd & Orange Ave	Signal	6.0	A	12.8	B	--	--	22.4	C	11.3	B





PROPOSED DEVELOPMENT AND TRIP GENERATION

The proposed development consists of 40 townhouse units and an 8,793 square foot restaurant. To determine the impact of this development, an analysis of its trip generation characteristics was conducted. This included the determination of the trips to be generated as well as their distribution and assignment to the area roadways.

Trip Generation

Trip generation rates were obtained from the 11th Edition of the Institute of Transportation Engineers (ITE) *Trip Generation Manual*. **Table 3** provides a summary of the trip generation for the proposed uses. As shown, the proposed development is estimated to generate 1,274 daily trips, of which 119 will occur during the A.M. peak hour and 118 in the P.M. peak hour, Subtracting the pass-by trips results in new net trips to be added to the area roadways. The trip generation worksheets are included in the study methodology.

Table 3
Trip Generation Calculation Summary

ITE Code	Land Use	Size*	Daily		A.M. Peak Hour				P.M. Peak Hour			
			Rate*	Trips	Rate*	Enter	Exit	Total	Rate*	Enter	Exit	Total
220	Townhouses	40 DU	8.30	332	0.875	8	27	35	0.950	24	14	38
932	Sit-Down Restaurant	8,793 KSF	107.20	942	9.57	46	38	84	9.05	49	31	80
Total Trips				1,274	----	54	65	119	----	73	45	118
Pass-by Trips (43%)				405	----	20	16	36	----	19	13	32
New Net Trips				869	----	34	49	83	----	54	32	86

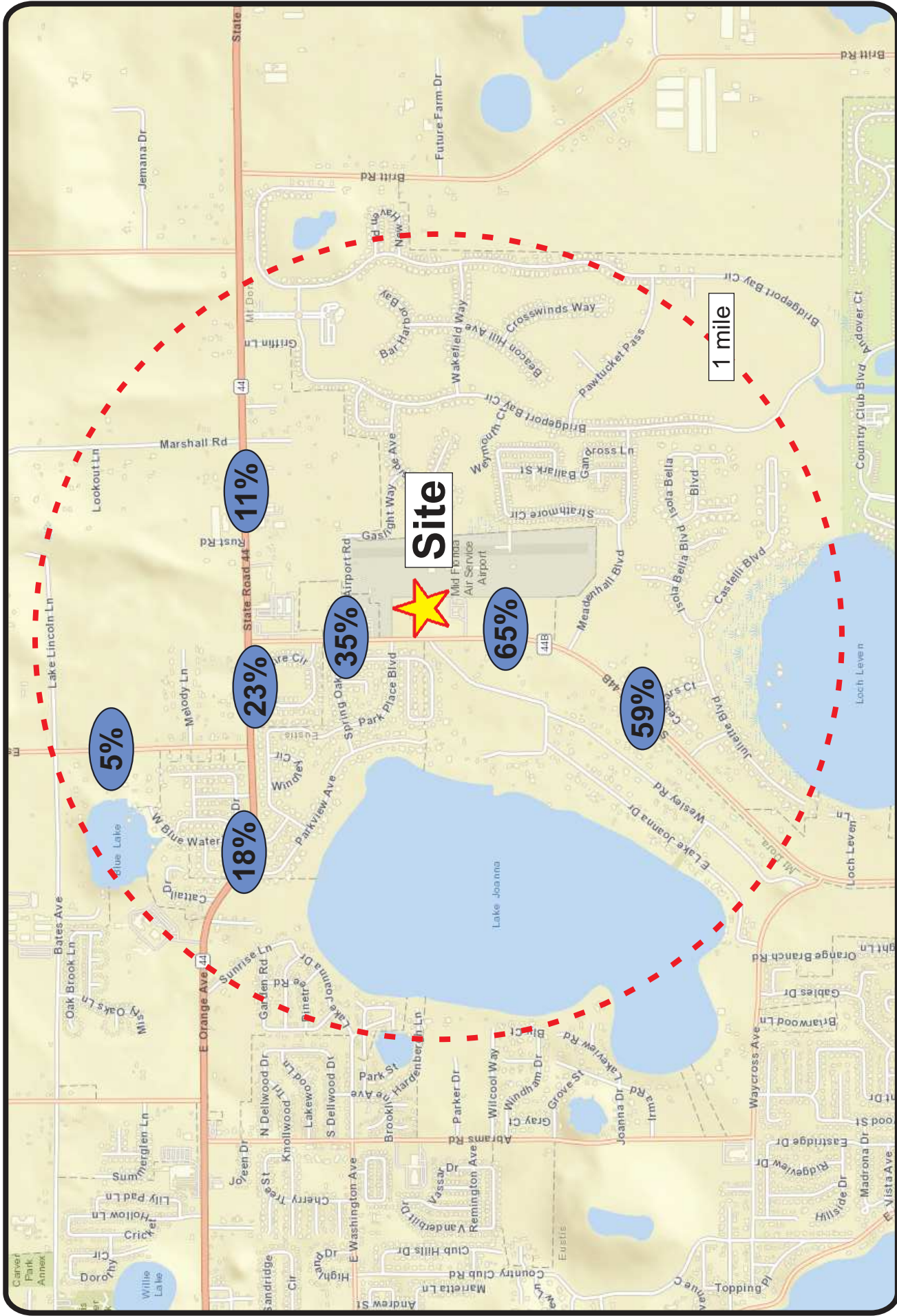
* DU=Dwelling Unit, KSF=1,000 Square Feet

** Equation Used when R²>0.75

Trip Distribution/Trip Assignment

The trip distribution pattern for the proposed project was estimated using the currently adopted Central Florida Regional Planning Model. A Select Zone Analysis (SZA) was conducted by modifying the CFRPM model network to include a Traffic Analysis Zone (TAZ) representing the proposed project and the model's socio-economic data updated to reflect the proposed project buildout. The trip distribution model plot is included in the study methodology. The trip distribution in the impact area is illustrated in **Figure 4**. Utilizing this distribution, the development project trips were assigned to the area roadways.





Trip Distribution

Huddle - Lake County
Project No 5802
Figure 4



PROJECTED TRAFFIC CONDITIONS

Projected traffic conditions were assessed in order to evaluate the impact of the proposed development within its area of influence. The projected conditions were estimated by combining the P.M. peak hour project trips with background traffic volumes.

Background Traffic Projections

Projected traffic volumes consist of background traffic combined with site generated traffic. Typically, background traffic volumes are determined by expanding existing peak hour traffic volumes to the buildout year using an annual growth rate. Annual growth rates for the study roadways were obtained from the Lake County CMP Database which indicated an annual 2.75% growth on Estes Drive and 1.00 % on SR 44. For roadway segments with a growth rate of less than 2.00%, a minimum of 2.00% was used. The growth rates were applied to the existing traffic volumes in order to determine the projected background volumes in the project buildout year in 2025.

Roadway Segment Analysis

The projected roadway segment analysis was performed by comparing the total projected P.M. peak hour traffic volume of each segment with the respective capacity at the adopted LOS standard. The projected P.M. peak hour analysis, as summarized in **Table 4**, revealed that the study roadway segments will continue to operate within the adopted LOS standards upon the addition of project trips except for the segment of SR 44 from US 441 to Waycross Avenue which is failing under existing conditions, and the segment of SR 44 from Waycross Avenue to Orange Avenue which will fail with or without the project trips under projected conditions. SR 44 from US 441 to Orange Avenue is planned to be widened by FDOT to four lanes with design underway.

**Table 4
Projected P.M. Peak Hour Roadway Analysis**

Roadway Segment	Lns	LOS		Peak Direction	P.M. Peak Hour Peak Direction Volume			V/C Ratio	LOS
		Standard	Capacity		Background*	Project**	Total		
SR 44									
US 441 to Waycross Ave	2	D	970	NB	1,284	30	1,314	1.35	F
Waycross Ave to Orange Ave	2	D	920	NB	943	35	978	1.06	F
Abrams Ave to Thrill Hill Rd	2	D	920	EB	734	12	746	0.81	C
Estes Road									
Lake Lincoln Ln to SR 44	2	D	840	NB	276	2	278	0.33	C

* Existing counts X 1.055 for Estes Dr and Existing count X 1.04 for SR 44

** Highest trips on the segment



Intersection Analysis

The projected traffic volumes at the study intersections are depicted in **Figure 5**. The figure shows the background P.M. peak hour volumes combined with project trips. The intersections were analyzed similar to the existing conditions analysis utilizing HCS software in accordance with the *Highway Capacity Manual* (HCM). The results of this analysis as summarized in **Table 5** indicate satisfactory traffic operating conditions at the study intersections except for the intersection of SR 44 and US 441 which is failing under existing conditions. With signal timing optimization, the intersection will still operate over-capacity with failing northbound and southbound approaches, but the overall delay for the intersection will be much improved. The minor approaches of SR 44 and Lake Joanna Drive/site access intersection are failing; however, the v/c ratios are less than 1.00, indicating the failing Levels of Service are caused due to the existing stop-control at the intersection and not a capacity deficiency. The HCS capacity analysis worksheets are included in **Appendix D**.

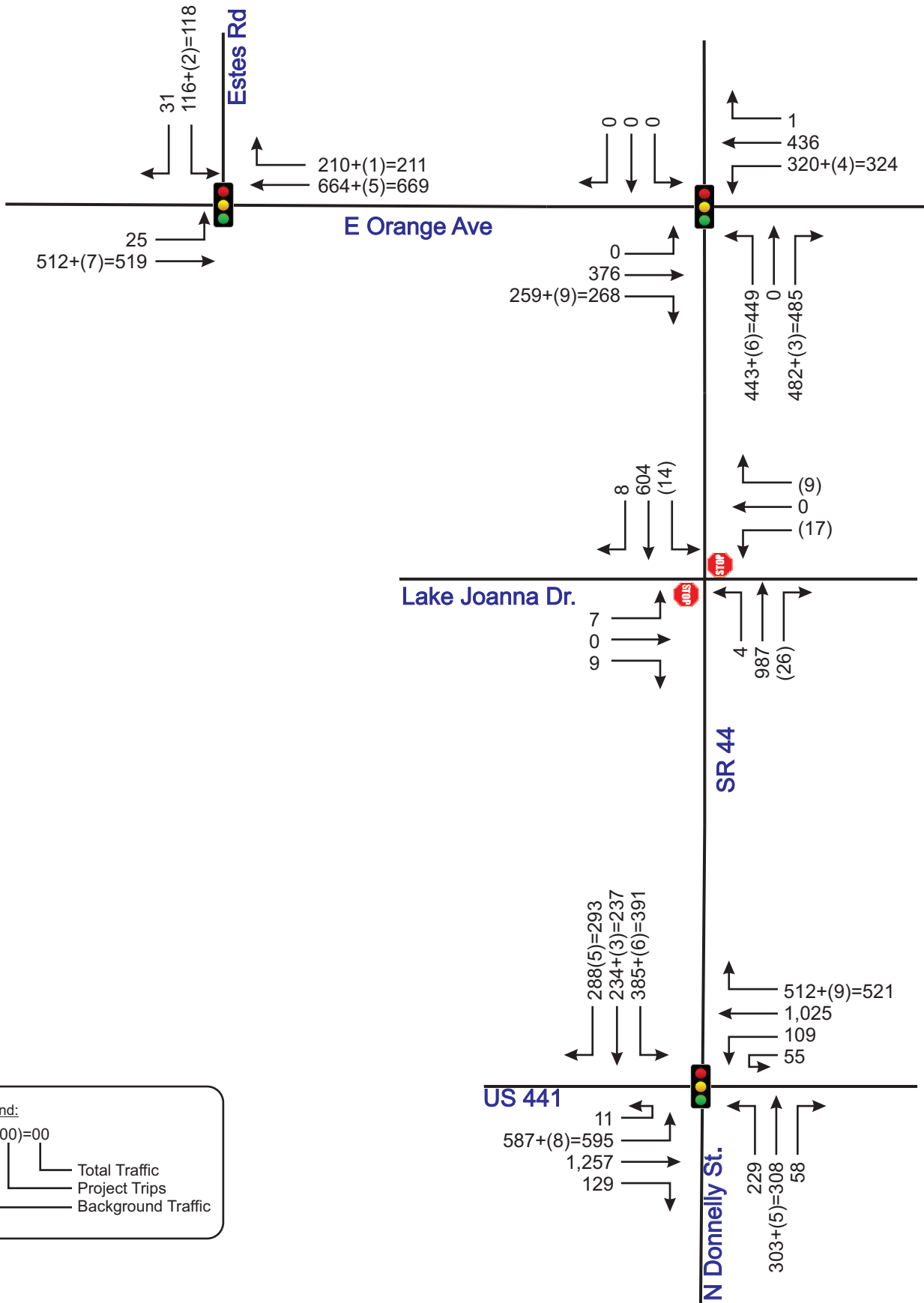
Table 5
Projected Intersection Capacity Analysis

Intersection	Control	EB		WB		NB		SB		Overall	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
SR 44 & Orange Ave	Signal	32.4	C	17.8	B	42.8	D	0.0	A	31.8	C
SR 44 & Lake Joanna Dr/Site Access	Stop	51.1*	F	100.4**	F	0.2	A	0.8	A	--	--
SR 44 & US 441	Signal	724.1	F	668.0	F	50.1	D	47.3	D	509.4	F
SR 44 & US 441 - Optimized	Signal	64.5	E	78.7	E	133.5	F	87.9	F	81.2	F
Estes Rd & Orange Ave	Signal	6.0	A	12.9	B	--	--	23.7	C	11.5	B

* v/c Ratio =0.19

** v/c Ratio =0.46





Turn Lane Analysis

Due to the heavy traffic volumes on SR 44, a separate left turn lane is warranted as per NCHRP Report 457 and should be provided. Based upon the guidelines contained in the FDOT Driveway Information Guide, a separate right turn lane is not warranted. Referenced data for separate turn lanes are included in **Appendix E**.



STUDY CONCLUSIONS

This traffic analysis was conducted in order to assess the traffic impact of the proposed Huddle development in Lake County. The project site is located on the east side SR 44 opposite Lake Joanna Drive. The project consists of 40 townhome residential units and an 8,793 square foot restaurant. Access to the site is proposed via a full access driveway on SR 44.

- The proposed development is estimated to generate 869 new net daily trips, 83 A.M. new net peak hour trips and 86 P.M. new net peak hour trips.
- The roadway segment capacity analysis indicates that the study roadway segments currently operate at satisfactory Levels of Service except for the segment of SR 44 from US 441 to Waycross Avenue which is failing under existing conditions. In the projected conditions another segment of SR 44 from Waycross Avenue to Orange Avenue will fail with or without project traffic. Other roadway segments within the study area are projected to operate at satisfactory Levels of Service.
- SR 44 from US 441 to Orange Avenue is planned to be widened by FDOT to four lanes. The design is under way but the construction schedule not determined yet.
- The intersection capacity analysis indicates that the SR 44/US 441 intersection is currently operating at LOS F due to high volumes on US 441. With optimization, the operation of the intersection will be much improved but still failing. Other intersections currently operate satisfactorily and will continue to do so at project buildout.
- The proposed development will be served by an access driveway on SR 44 opposite Joanne Drive. Due to heavy traffic volumes on SR 44, a southbound left turn lane is recommended and should be provided.



APPENDICES

APPENDIX A

Study Methodology and Related Correspondence

Rita Merhi

From: Lewis, Sharon E <sharon.lewis@lakecountyfl.gov>
Sent: Monday, May 15, 2023 4:39 PM
To: Rita Merhi
Cc: Turgut Dervish; Earhart, Jeffrey; Lynch, Seth
Subject: RE: TPD#5802 Huddle
Attachments: 5802 - Huddle Methodology Comments.pdf

Rita,

Please see my comments in the attached methodology



SHARON E LEWIS, MSCTM
Traffic Project Engineer

PUBLIC WORKS
Engineering

A P.O Box 7800, Tavares, FL 32778
P 352-253-9050 | F 352-253-6016

E Sharon.Lewis@lakecountyfl.gov | W www.lakecountyfl.gov

NOTE: Florida has a very broad public records law.
Your email communications may be subject to public disclosure.

From: Rita Merhi <rita@tpdtraffic.com>
Sent: Friday, April 28, 2023 1:37 PM
To: Lewis, Sharon E <sharon.lewis@lakecountyfl.gov>
Cc: Turgut Dervish <turgut@tpdtraffic.com>
Subject: RE: TPD#5802 Huddle

CAUTION: This email originated from outside of your organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Good afternoon Sharon,

Please use the attached version for the proposed methodology. The one I sent earlier had a typo on the distribution figure.

Sorry for the inconvenience.

Thank you for your assistance in reviewing the attached methodology.

Have a great weekend.

Regards,

Rita Merhi

Traffic Planning and Design, Inc.
535 Versailles Drive

Rita Merhi

From: Lynch, Seth <seth.lynch@lakecountyfl.gov>
Sent: Tuesday, May 16, 2023 3:00 PM
To: Lewis, Sharon E; Rita Merhi
Cc: Turgut Dervish; Earhart, Jeffrey
Subject: RE: TPD#5802 Huddle

It is highly recommended that turn lane on SR 44 be added at this intersection.

Thanks,
Seth



SETH LYNCH

Development Engineer/Project Manager

DEPARTMENT OF PUBLIC WORKS
Engineering Division, Development Section

A P.O. BOX 7800, 350 N. Sinclair Ave, Tavares, FL, 32778
P 352-253-9052
E slynch@lakecountyfl.gov | W www.lakecountyfl.gov

*NOTE: Florida has a very broad public records law.
Your email communications may be subject to public disclosure.*

From: Lewis, Sharon E <sharon.lewis@lakecountyfl.gov>
Sent: Monday, May 15, 2023 4:39 PM
To: Rita Merhi <rita@tpdtraffic.com>
Cc: Turgut Dervish <turgut@tpdtraffic.com>; Earhart, Jeffrey <jeff.earhart@lakecountyfl.gov>; Lynch, Seth <seth.lynch@lakecountyfl.gov>
Subject: RE: TPD#5802 Huddle

Rita,

Please see my comments in the attached methodology



SHARON E LEWIS, MSCTM
Traffic Project Engineer

PUBLIC WORKS
Engineering


A P.O Box 7800, Tavares, FL 32778
P 352-253-9050 | F 352-253-6016
E Sharon.Lewis@lakecountyfl.gov | W www.lakecountyfl.gov

*NOTE: Florida has a very broad public records law.
Your email communications may be subject to public disclosure.*

From: Rita Merhi <rita@tpdtraffic.com>
Sent: Friday, April 28, 2023 1:37 PM
To: Lewis, Sharon E <sharon.lewis@lakecountyfl.gov>



TO: Sharon Lewis, MS
 Lake County Public Works

FROM: Turgut Dervish, P.E. 

DATE: April 28, 2023

RE: **Traffic Impact Analysis Methodology**
 Huddle – Lake County
 TPD No. 5802

The following is an outline of the proposed methodology for the Traffic Impact Study for the Huddle residential development in Lake County, Florida. The project site is located on the east side of the intersection of SR 44 and Lake Joanna Drive. **Figure 1** depicts the site location and the area roadways.


1. Proposed Development

The proposed development will consist of 40 townhomes and an 8,793 square foot restaurant. The site is proposed to be served via a full access driveway which will serve as the westbound approach of the intersection of SR 44 and Lake Joanna Drive. **Figure 2** is a conceptual site plan of the development and access configuration. The development is anticipated to be built by the end of 2025.

2. Trip Generation

Trip generation data from the 11th Edition of the Institute of Transportation Engineers (ITE) *Trip Generation Manual* will be used for the trip generation estimation of the development. **Table 1** provides a summary of the trip generation for the proposed development calculated with the ITE data. The project is expected to generate a total of 791 net new daily trips, of which 63 will occur during the A.M. peak hour and 66 will occur during P.M. peak hour. The ITE trip generation worksheets are included in **Attachment A**.

Table 1
Trip Generation Calculation Summary


ITE Code	Land Use	Size*	Daily		A.M. Peak Hour				P.M. Peak Hour			
			Rate	Trips	Rate	Enter	Exit	Total	Rate	Enter	Exit	Total
215	Single-Family Attached Housing	40 DU	6.35**	254	0.38**	4	11	15	0.50**	12	8	20
932	High-Turnover (Sit-Down) Restaurant	8.79 KSF	107.20	942	9.57	46	38	84	9.05	49	31	80
Total Trips:				1,196	--	50	49	99	--	61	39	100
Restaurant Pass-By (4 				405	--	20	16	36	--	21	13	34
Net New Trips:				791	--	30	33	63	--	40	26	66

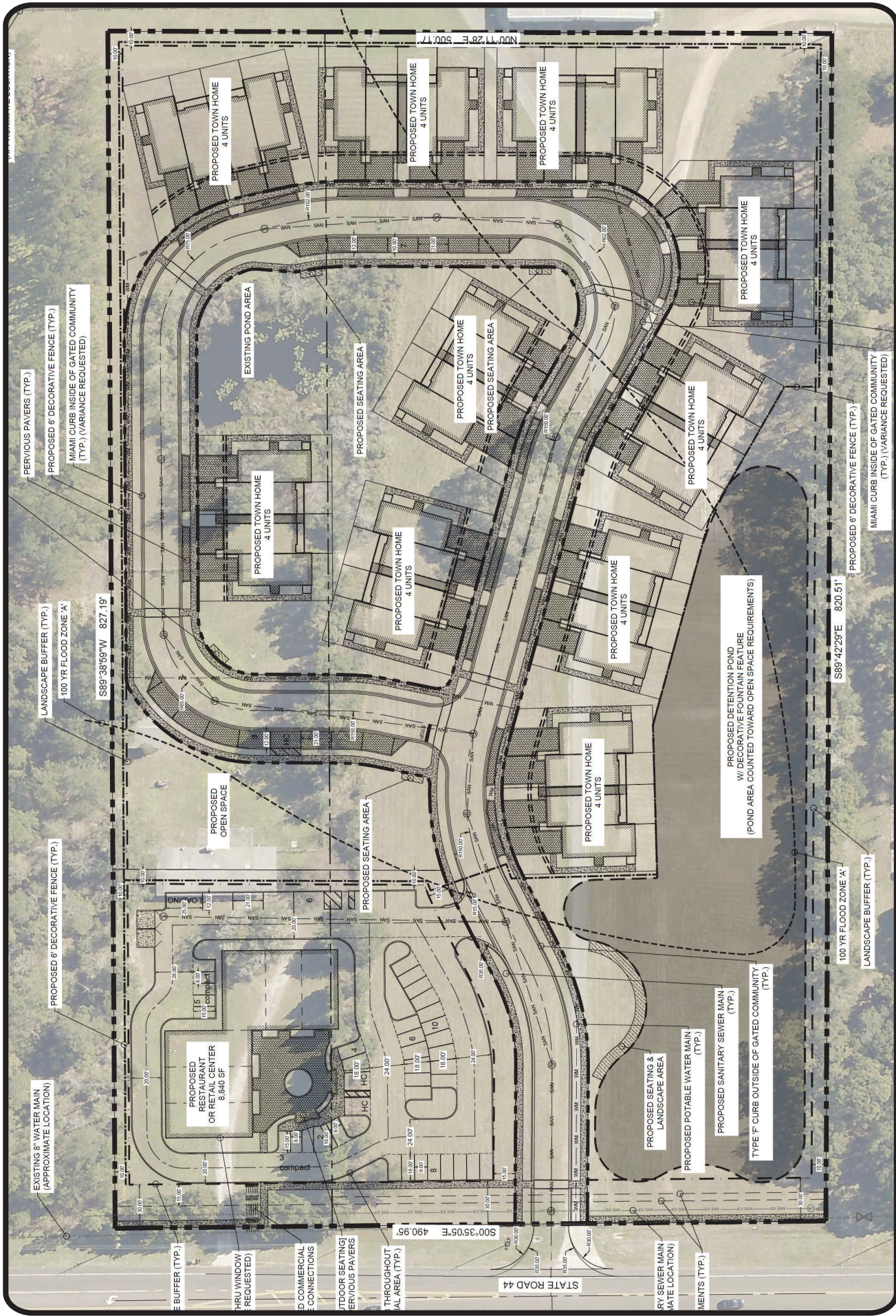
* DU = Dwelling Units, KSF = 1,000 square feet

** R² > 0.75, therefore equations used

Summary of Comments on Microsoft Word - 5802 - Huddle Methodology

Page: 1

 Number: 1 Author: sharon.lewis Subject: Sticky Note Date: 5/15/2023 3:31:35 PM
Should be 34%



Site Plan

Huddle - Lake County
 Project No 5802
 Figure 2



3. Trip Distribution

The trip distribution pattern for the proposed project was estimated using the CFRPM model. The trip distribution pattern in the project vicinity is illustrated in **Figure 3**. The model generated plots are included in **Attachment B**.

4. Impact Area

As per Lake-Sumter MPO’s Traffic Impact Study Methodology and Guidelines, the study will be a Tier 1 TIS. These guidelines require that the impact area of the development include an area within a minimum of a one-mile radius from the main access point of the proposed project. A significance analysis was conducted to determine the impact of the proposed development on the roadways in the project’s impact area. The results of the analysis are summarized in **Table 2**, which shows that no roadway within the project’s one-mile impact area will be significantly impacted. Therefore, the following roadway segments and intersections are proposed to be included in the analysis:

The roadway segments to be included in the analysis:

- SR 44, Waycross Avenue to Orange Avenue
- Orange Avenue, Abrams Road to Thrill Hill Road
- Estes Road, Lake Lincoln Lane to SR 44

The intersections to be included in the area analysis are:

- SR 44 and Orange Avenue
- Estes Road and Orange Avenue
- SR 44 and Lake Joanna Drive/Site Access

**Table 2
 Significance Analysis**

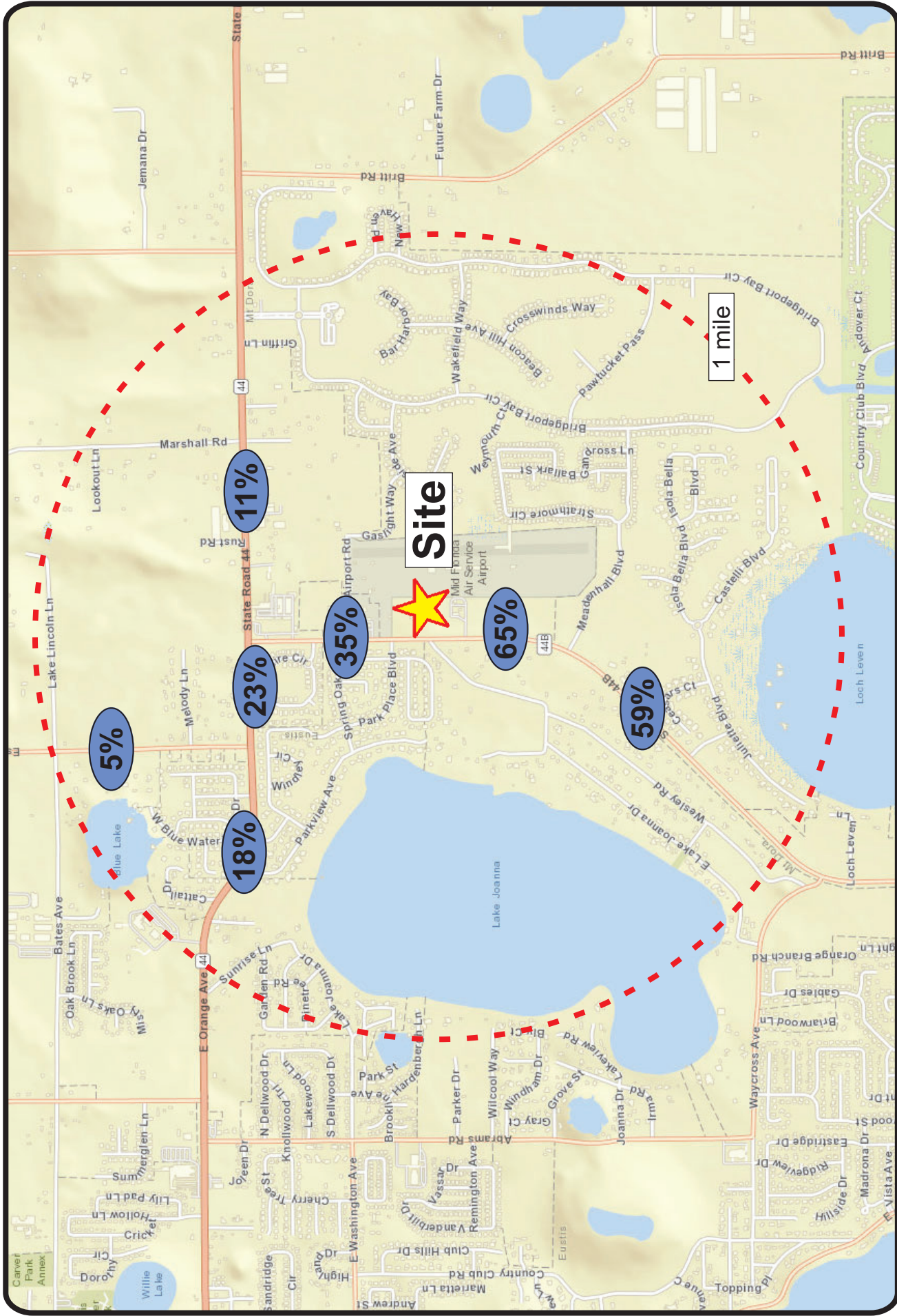
Segment ID	Roadway Segment	Lanes	LOS Standard	Capacity	Direction	Trip Distribution*	Project Trips	Significance
SR 44								
3168	Waycross Ave to Orange Ave	2U	D	920	NB	59%	24	2.61%
					SB	59%	15	1.63%
Orange Avenue (SR 44)								
3270	Abrams Rd to Thrill Hill Rd	2U	D	920	EB	23%	9	0.98%
					WB	23%	6	0.65%
Estes Road								
1850	Lake Lincoln Ln to SR 44	2U	D	840	NB	5%	1	0.12%
					SB	5%	2	0.24%

* Highest on Segment

Page: 4

Number: 1 Author: sharon.lewis Subject: Sticky Note Date: 5/15/2023 4:26:47 PM
The intersection of US 441 & SR 44 (CR 44B)

Number: 2 Author: sharon.lewis Subject: Sticky Note Date: 5/15/2023 4:25:06 PM
Waycross Ave to US 441 need to be included



Trip Distribution

Huddle - Lake County
Project No 5802
Figure 3



5. Traffic Impact Assessment

a) Roadway

- Obtain existing traffic volumes on study roadway segments from Lake County CMP Database for use in the traffic analysis.
- Determine background traffic will be determined with the use of an annual growth rate obtained from historical AADT in the vicinity of the project. A minimum 2% growth rate will be used.
- Combine project traffic with background traffic to obtain total traffic volumes.
- Perform daily and PM peak hour/peak direction roadway analyses utilizing Lake County LOS standards.

b) Intersections

- Conduct intersection counts and use seasonal factors to adjust intersection data during the A.M. and P.M. peak periods at the study intersections.
- Determine background traffic with the use of an annual growth rate obtained from historical AADT. A minimum of 2% annual growth rate will be used.
- Combine project traffic with background traffic to obtain total traffic.
- Perform intersection capacity analysis utilizing the HCS or Synchro operational analysis procedures for the A.M. and P.M. peak hours.

6. Traffic Report

Prepare traffic report summarizing study procedures, analyses, and recommendations. If you have any questions or concerns, please contact us at (407) 628-9955.

Attachment A

Single-Family Attached Housing (215)

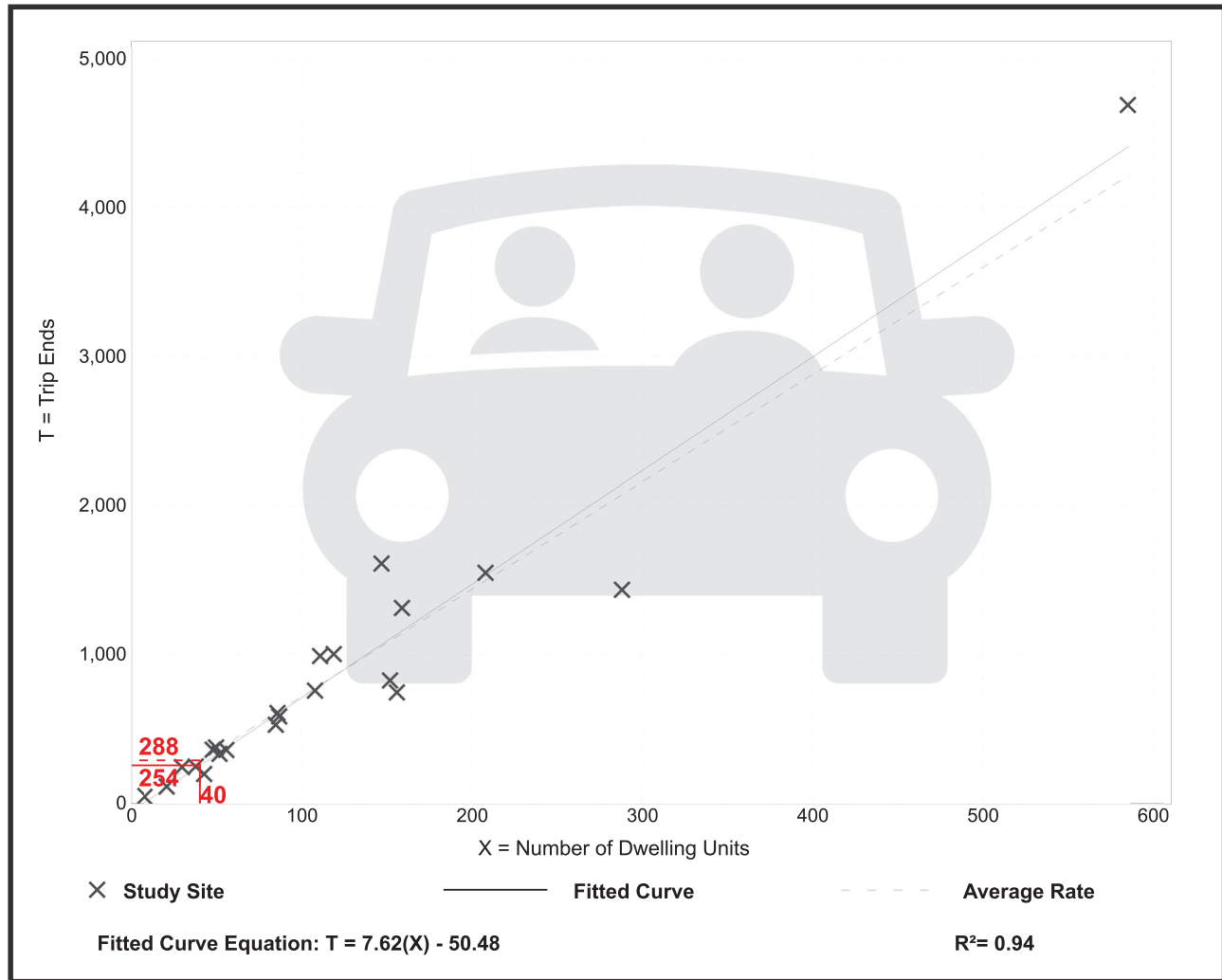
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban
Number of Studies: 22
Avg. Num. of Dwelling Units: 120
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
7.20	4.70 - 10.97	1.61

Data Plot and Equation



Single-Family Attached Housing (215)

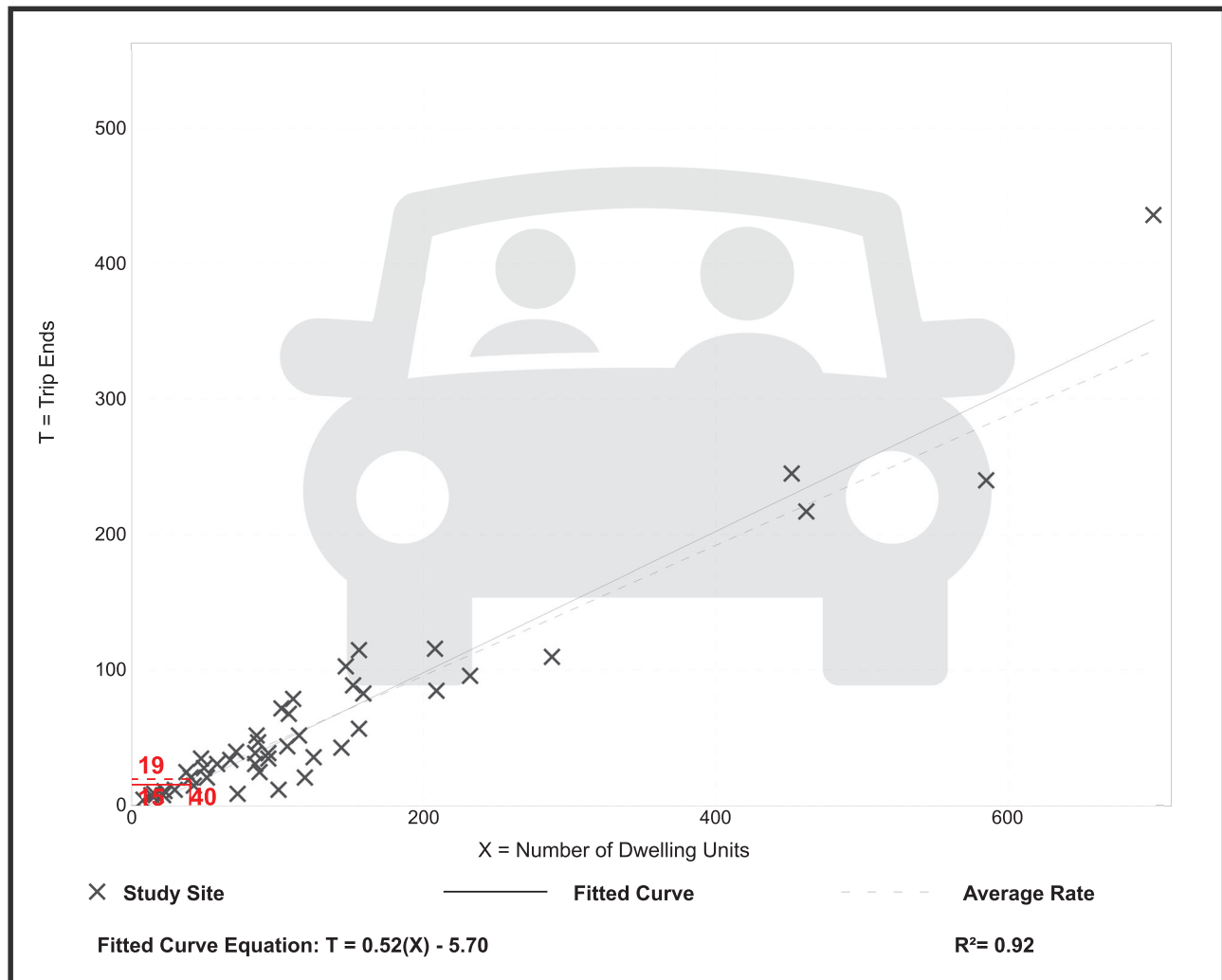
Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Setting/Location: General Urban/Suburban
 Number of Studies: 46
 Avg. Num. of Dwelling Units: 135
 Directional Distribution: 25% entering, 75% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.48	0.12 - 0.74	0.14

Data Plot and Equation



High-Turnover (Sit-Down) Restaurant (932)

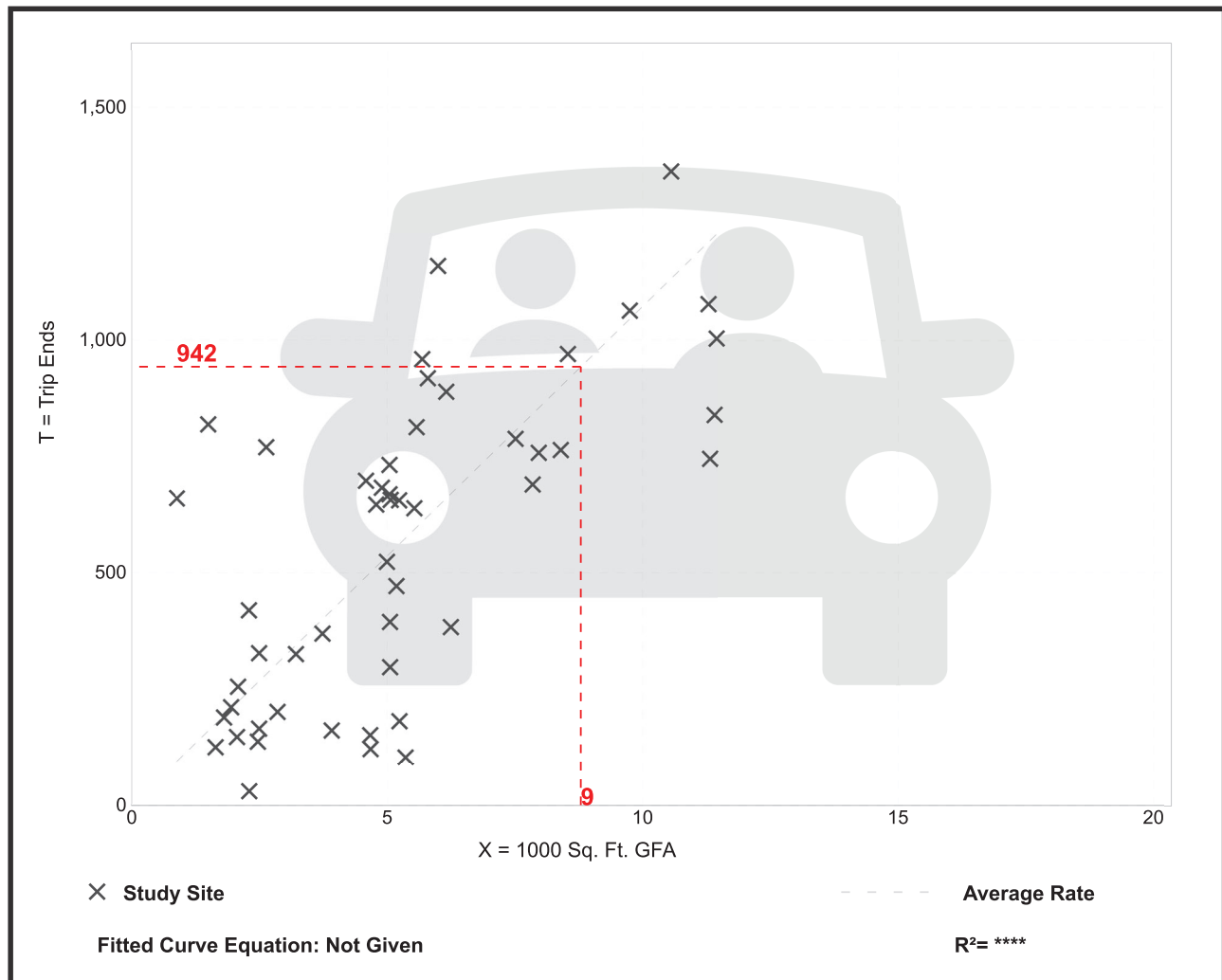
Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday

Setting/Location: General Urban/Suburban
Number of Studies: 50
Avg. 1000 Sq. Ft. GFA: 5
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
107.20	13.04 - 742.41	66.72

Data Plot and Equation



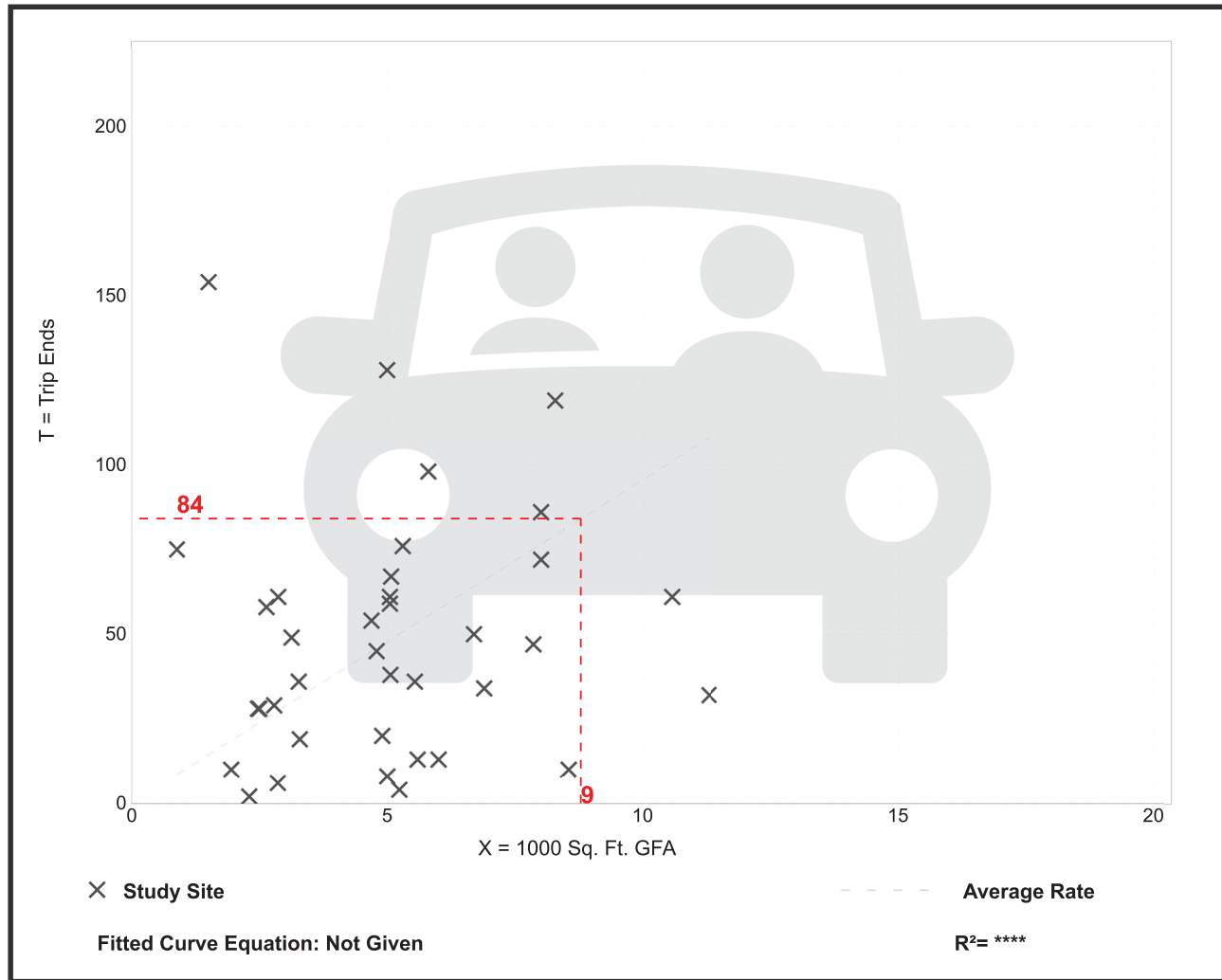
High-Turnover (Sit-Down) Restaurant (932)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 7 and 9 a.m.
Setting/Location: General Urban/Suburban
 Number of Studies: 37
 Avg. 1000 Sq. Ft. GFA: 5
 Directional Distribution: 55% entering, 45% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
9.57	0.76 - 102.39	11.61

Data Plot and Equation



Single-Family Attached Housing (215)

Vehicle Trip Ends vs: Dwelling Units
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

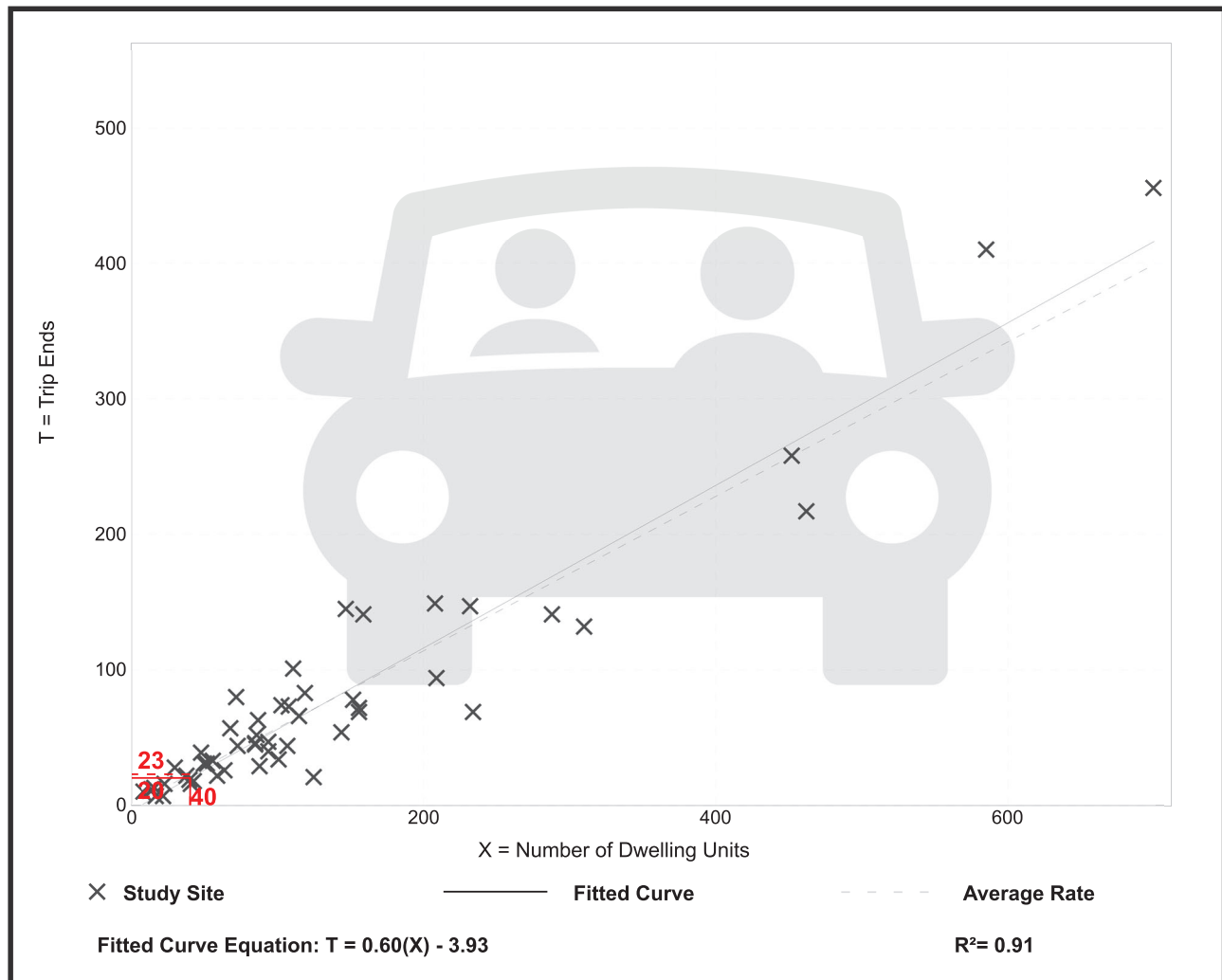
Setting/Location: General Urban/Suburban

Number of Studies: 51
 Avg. Num. of Dwelling Units: 136
 Directional Distribution: 59% entering, 41% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.57	0.17 - 1.25	0.18

Data Plot and Equation



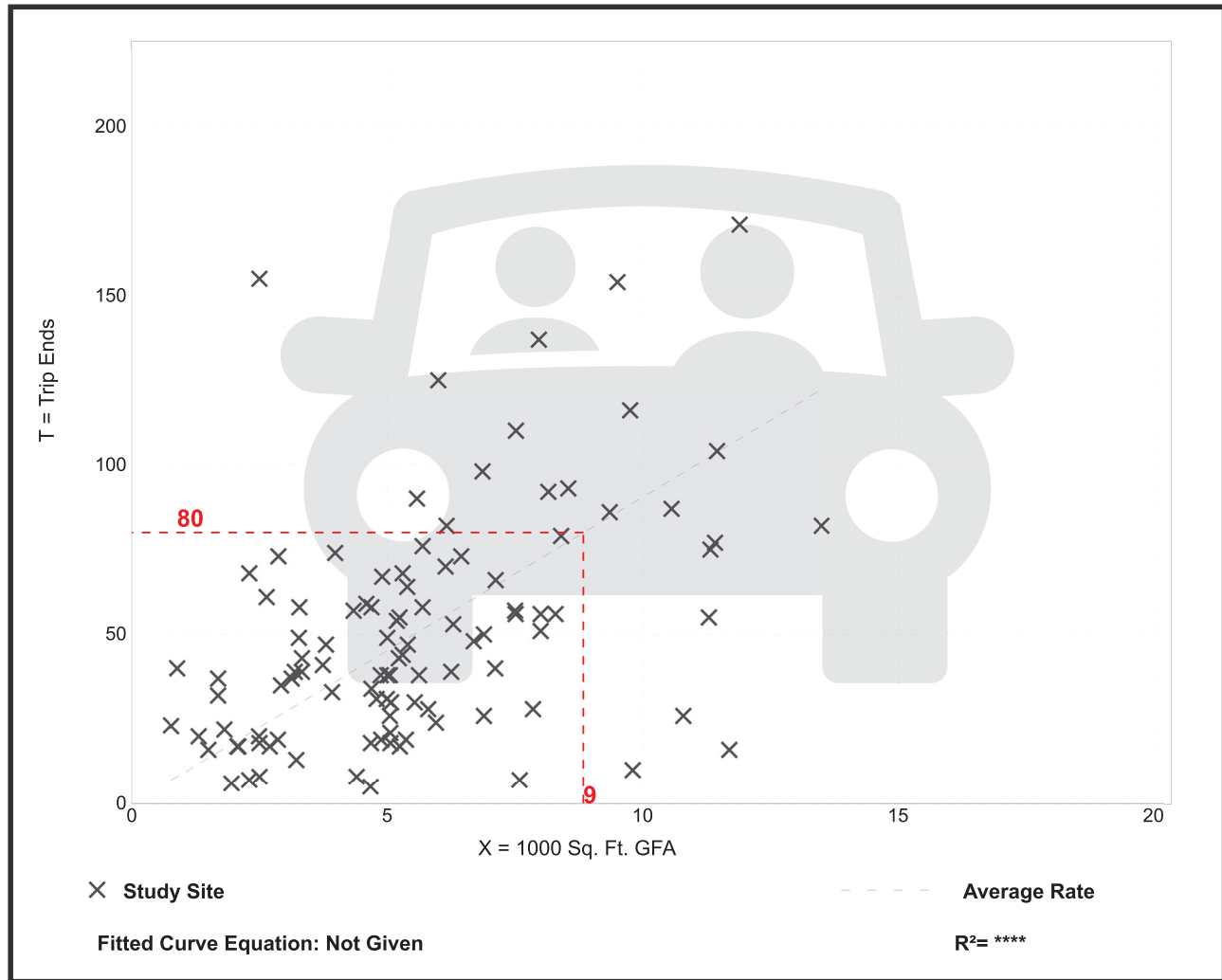
High-Turnover (Sit-Down) Restaurant (932)

Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
 Number of Studies: 104
 Avg. 1000 Sq. Ft. GFA: 6
 Directional Distribution: 61% entering, 39% exiting

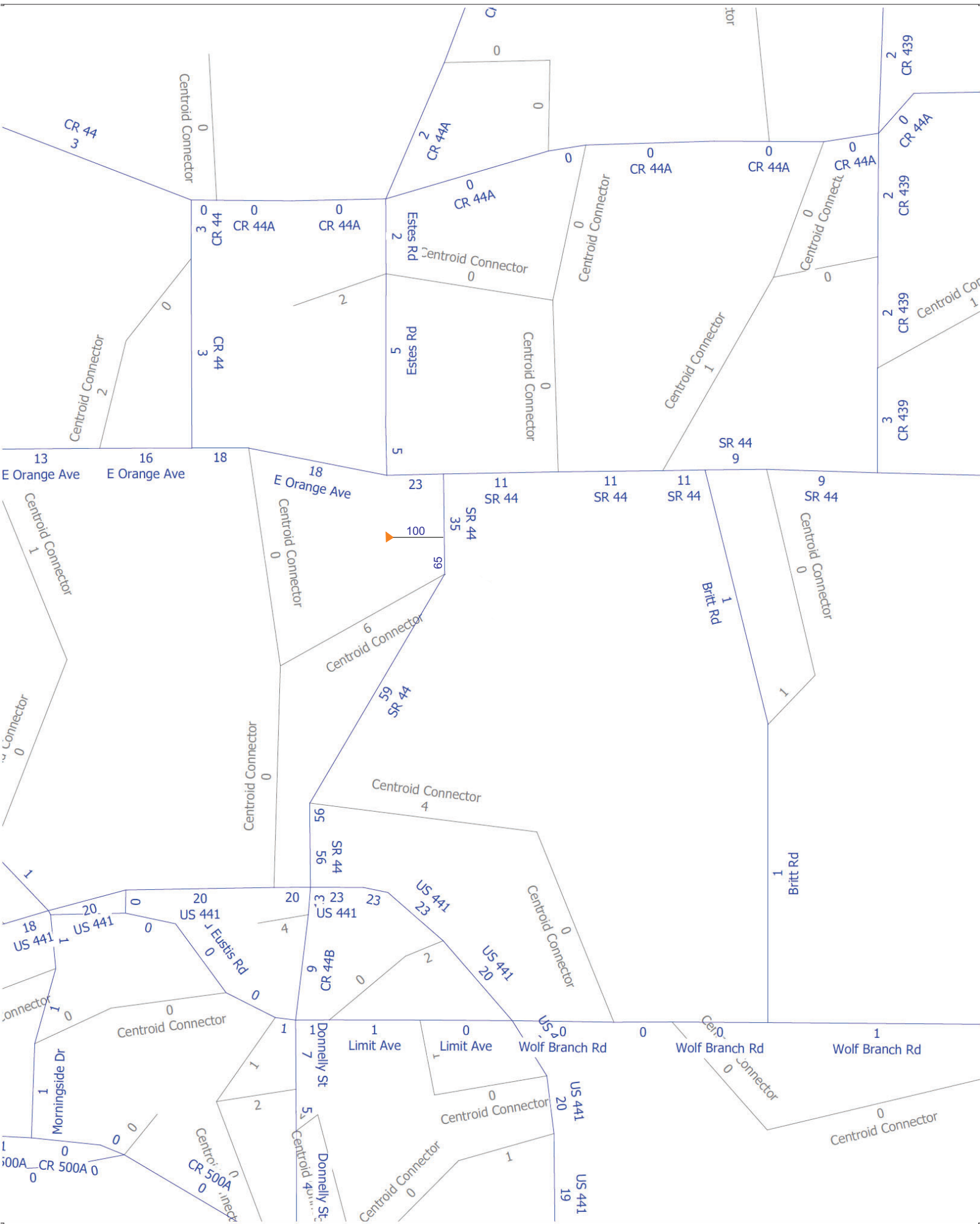
Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
9.05	0.92 - 62.00	6.18

Data Plot and Equation



Attachment B



APPENDIX B

Intersection Traffic Counts/FDOT Seasonal Factors/Signal Timings

15 MINUTE TURNING MOVEMENT COUNTS

(Cars and Trucks)

DATE: May 10, 2023 (Wednesday)
 LOCATION: SR 44 & E Orange Av

CITY: Eustis
 COUNTY: Lake County

LATITUDE: 0
 LONGITUDE: 0

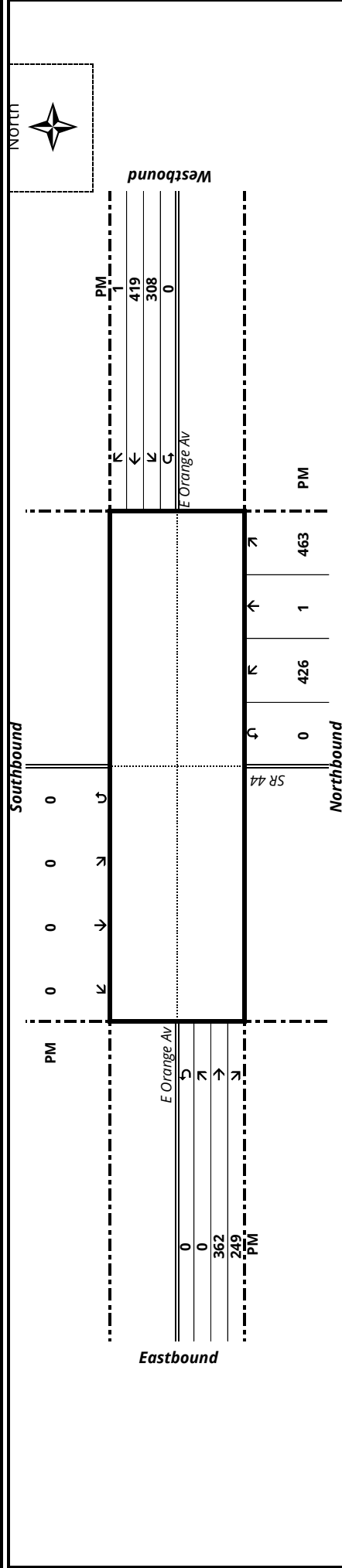
SR 44

E Orange Av

E Orange Av

TIME BEGIN	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			E/W TOTAL	GRAND TOTAL	
	L	T	R	L	T	R	L	T	R	L	T	R			
04:00 PM	108	0	95	0	0	0	0	81	55	0	111	0	177	313	516
04:15 PM	113	0	99	0	0	0	0	76	56	0	85	0	149	281	493
04:30 PM	105	0	69	0	0	0	0	72	71	0	109	0	205	348	522
04:45 PM	105	0	98	0	0	0	0	90	59	0	103	0	189	338	541
TOTAL	431	0	361	0	0	0	0	319	241	0	408	0	720	1,280	2,072
05:00 PM	100	0	115	0	0	0	0	96	62	0	109	0	184	342	557
05:15 PM	114	0	126	0	0	0	0	87	59	0	112	0	184	330	570
05:30 PM	107	1	124	0	0	0	0	89	69	0	95	1	171	329	561
05:45 PM	106	0	95	0	0	0	0	92	52	0	92	0	159	303	504
TOTAL	427	1	460	0	0	0	0	364	242	0	408	1	698	1,304	2,192

PM Peak													Peak Hour Factor: 0.978		
04:45 PM to 05:45 PM	426	1	463	0	0	0	0	362	249	0	419	1	728	1,339	2,229



15 MINUTE TURNING MOVEMENT COUNTS

(Trucks Only)

DATE: May 10, 2023 (Wednesday)
 LOCATION: SR 44 & E Orange Av

CITY: Eustis
 COUNTY: Lake County

LATITUDE: 0
 LONGITUDE: 0

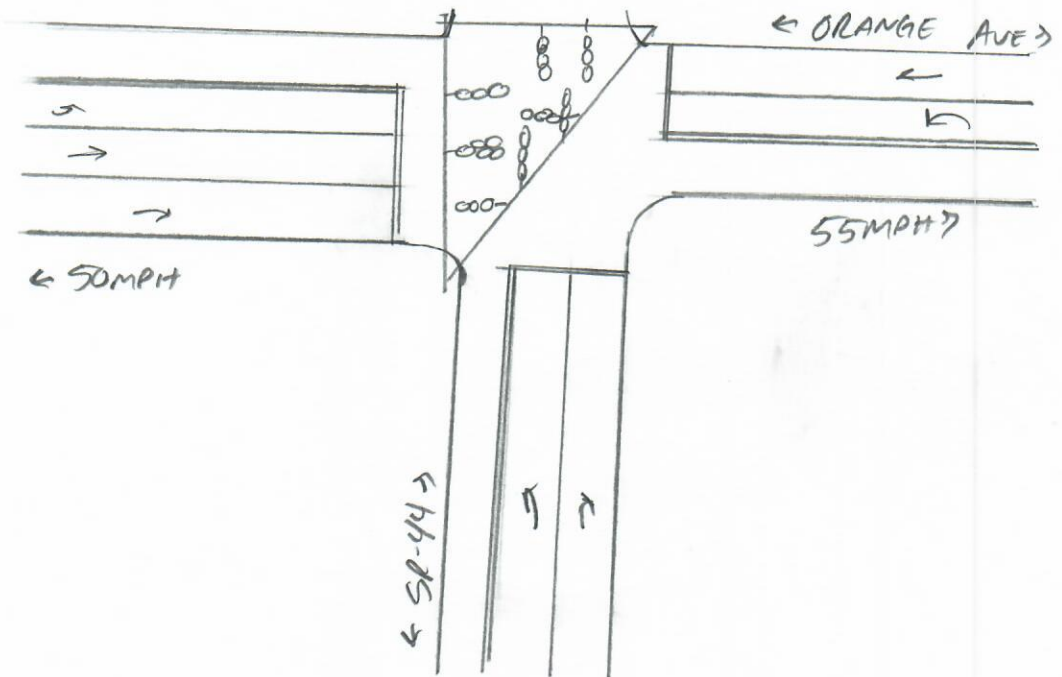
SR 44

E Orange Av

E Orange Av

TIME BEGIN	NORTHBOUND			SOUTHBOUND			N/S TOTAL			EASTBOUND			WESTBOUND			E/W TOTAL	GRAND TOTAL			
	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R					
04:00 PM	2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3	0	3	3
04:15 PM	2	0	1	0	0	0	0	0	0	3	0	0	2	1	0	0	5	0	5	8
04:30 PM	1	0	1	0	0	0	0	0	0	2	0	0	0	0	1	0	3	0	3	4
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	0	2	4
TOTAL	5	0	2	0	0	0	0	0	0	7	0	0	3	3	0	0	13	0	13	19
05:00 PM	1	0	1	0	0	0	0	0	0	2	0	0	1	1	0	1	1	0	2	4
05:15 PM	1	0	2	0	0	0	0	0	0	3	0	0	1	1	0	1	1	0	2	4
05:30 PM	2	0	2	0	0	0	0	0	0	4	0	0	1	0	0	0	2	0	2	3
05:45 PM	2	0	2	0	0	0	0	0	0	4	0	0	1	0	0	0	1	0	1	2
TOTAL	6	0	7	0	0	0	0	0	0	13	0	0	4	2	0	2	5	0	7	13

PM Peak																								
04:45 PM to 05:45 PM																								
4	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	0	0	8	15	24



15 MINUTE TURNING MOVEMENT COUNTS

(Cars and Trucks)

DATE: May 10, 2023 (Wednesday)

CITY: Eustis

LATITUDE: 0

LOCATION: SR 44 & E Lake Johanna Dr

COUNTY: Lake County

LONGITUDE: 0

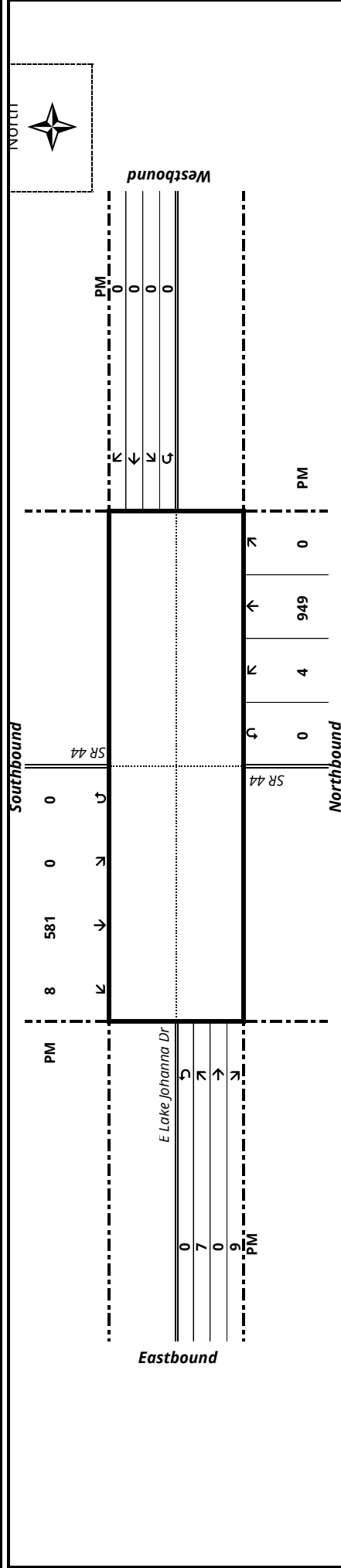
SR 44

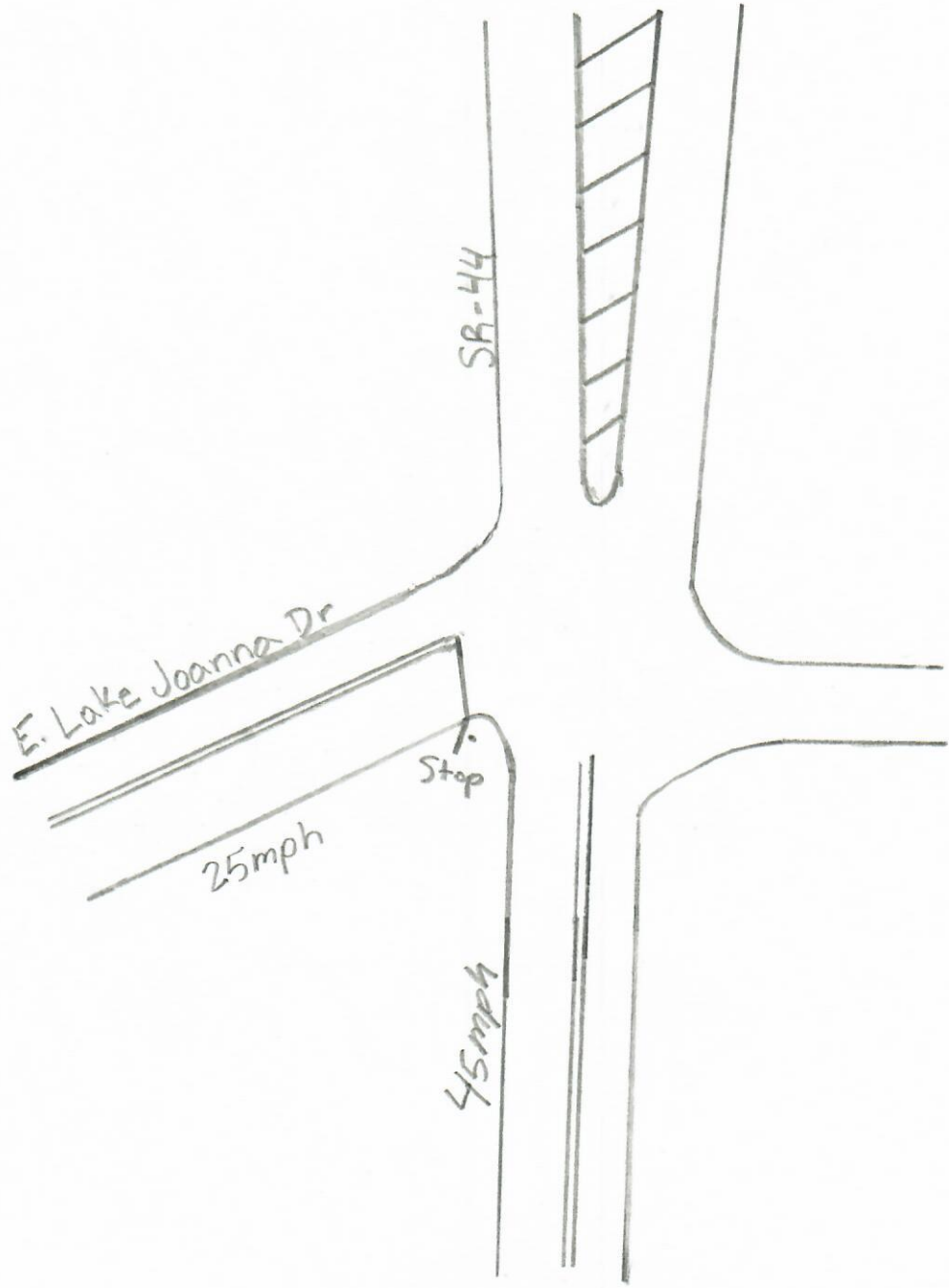
SR 44

E Lake Johanna Dr

TIME BEGIN	NORTHBOUND			SOUTHBOUND			N/S TOTAL			EASTBOUND			WESTBOUND			E/W TOTAL	GRAND TOTAL						
	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R								
04:00 PM	4	293	0	0	297	0	147	4	0	151	448	1	0	0	4	0	0	0	5	0	0	5	453
04:15 PM	0	223	0	0	223	0	131	2	0	133	356	1	0	0	3	0	0	0	4	0	0	4	360
04:30 PM	0	207	0	0	207	0	159	2	0	161	368	2	0	0	2	0	0	0	4	0	0	4	372
04:45 PM	0	226	0	0	226	0	144	0	0	144	370	3	0	0	0	0	0	0	3	0	0	3	373
TOTAL	4	949	0	0	953	0	581	8	0	589	1,542	7	0	0	9	0	0	0	16	0	0	16	1,558
05:00 PM	0	226	0	0	226	0	122	0	0	122	348	3	0	0	0	0	0	0	3	0	0	3	351
05:15 PM	1	257	0	0	258	0	156	3	0	159	417	1	0	1	0	0	0	0	2	0	0	2	419
05:30 PM	1	252	0	0	253	0	157	0	0	157	410	1	0	1	0	0	0	0	2	0	0	2	412
05:45 PM	0	201	0	0	201	0	123	3	0	126	327	3	0	0	0	0	0	0	3	0	0	3	330
TOTAL	2	936	0	0	938	0	558	6	0	564	1,502	8	0	2	0	0	0	0	10	0	0	10	1,512

PM Peak	Peak Hour Factor: 0.860																				
04:00 PM to 05:00 PM	4	949	0	0	953	0	581	8	0	589	1,542	7	0	9	0	16	0	0	0	16	1,558





15 MINUTE TURNING MOVEMENT COUNTS

(Cars and Trucks)

DATE: May 16, 2023 (Tuesday)

CITY: Mt Dora

LATITUDE: 0

LOCATION: Donnelly St/SR 44 & US 441

COUNTY: Lake County

LONGITUDE: 0

Donnelly St

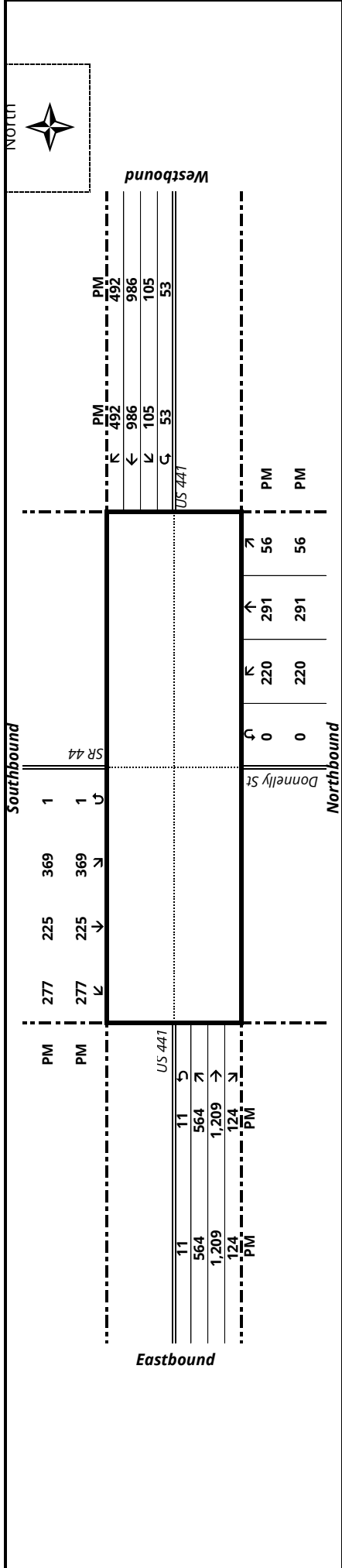
SR 44

US 441

US 441

TIME BEGIN	NORTHBOUND			SOUTHBOUND			N/S TOTAL			EASTBOUND			WESTBOUND			E/W TOTAL		GRAND TOTAL			
	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	U-turn	TOTAL				
04:00 PM	70	91	16	178	62	66	0	205	383	119	248	49	4	420	21	247	115	27	410	830	1,213
04:15 PM	71	88	17	176	45	65	0	190	366	151	311	42	7	511	30	278	119	18	445	956	1,322
04:30 PM	39	83	10	132	56	71	0	202	334	139	271	28	0	438	20	231	102	21	374	812	1,146
04:45 PM	53	78	15	146	65	88	1	259	405	155	320	23	0	498	27	216	101	9	353	851	1,256
TOTAL	233	340	58	632	228	290	1	856	1,488	564	1,150	142	11	1,867	98	972	437	75	1,582	3,449	4,937
05:00 PM	49	67	14	130	49	57	0	187	317	114	284	44	2	444	26	263	141	14	444	888	1,205
05:15 PM	54	78	16	148	58	63	0	211	359	162	349	27	8	546	33	252	114	19	418	964	1,323
05:30 PM	64	68	11	143	53	69	0	215	358	133	256	30	1	420	19	255	136	11	421	841	1,199
05:45 PM	47	62	9	120	88	54	1	196	316	119	252	58	12	441	40	277	98	17	432	873	1,189
TOTAL	214	275	50	541	352	214	1	809	1,350	528	1,141	159	23	1,851	118	1,047	489	61	1,715	3,566	4,916

PM Peak													Peak Hour Factor: 0.942																						
04:45 PM to 05:45 PM													220	291	56	0	567	369	225	277	1	872	1,439	564	1,209	124	11	1,908	105	986	492	53	1,636	3,544	4,983



15 MINUTE TURNING MOVEMENT COUNTS

(Trucks Only)

DATE: May 16, 2023 (Tuesday)

CITY: Mt Dora

LATITUDE: 0

LOCATION: Donnelly St/SR 44 & US 441

COUNTY: Lake County

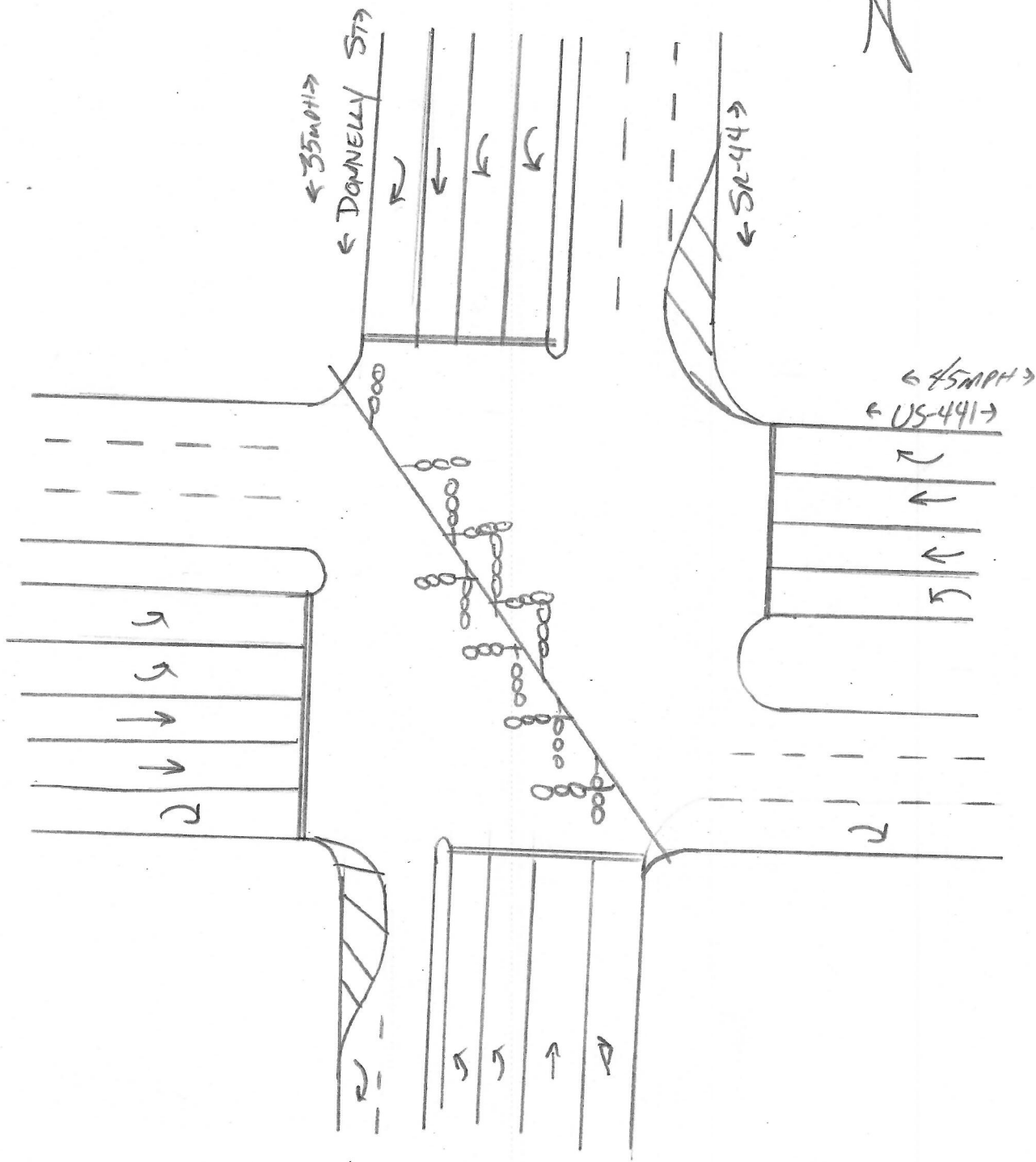
LONGITUDE: 0

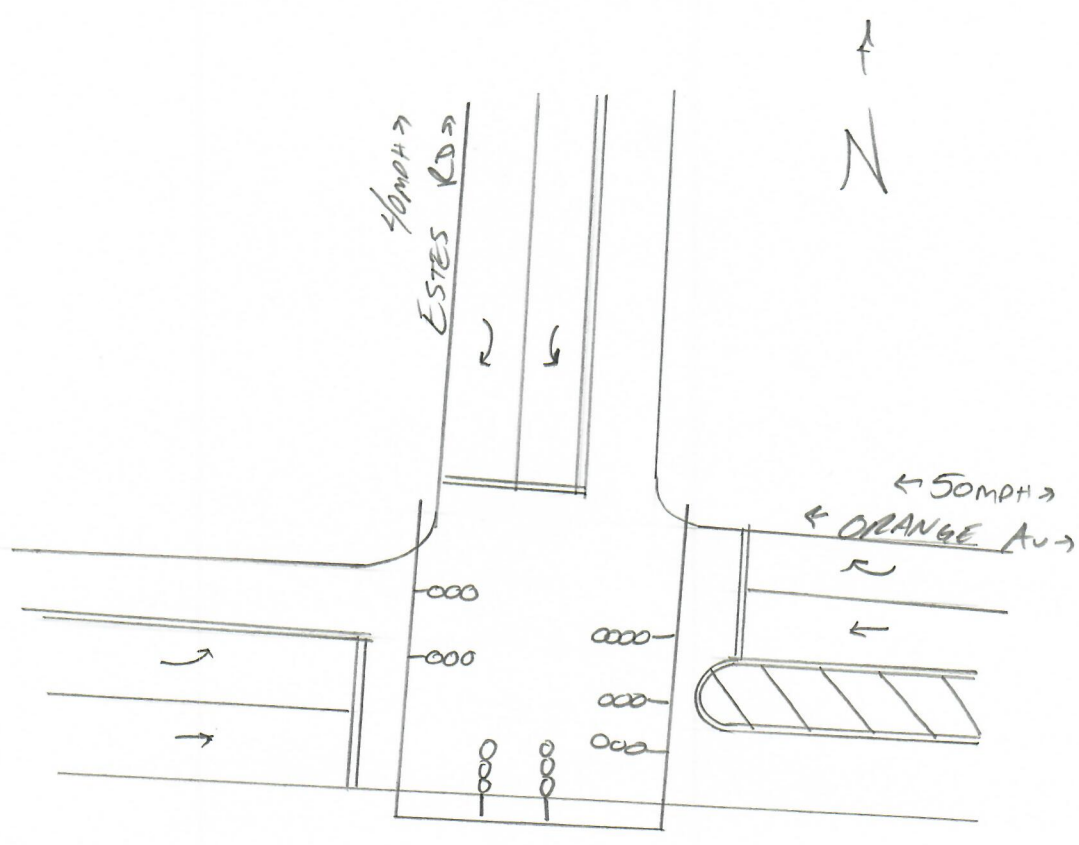
Donnelly St SR 44 US 441 US 441

TIME BEGIN	NORTHBOUND			TOTAL	SOUTHBOUND			TOTAL	N/S TOTAL	EASTBOUND			TOTAL	WESTBOUND			TOTAL	E/W TOTAL	GRAND TOTAL
	L	T	R		L	T	R			L	T	R		L	T	R			
04:00 PM	0	0	0	0	0	0	1	3	3	1	4	0	5	0	3	1	4	9	12
04:15 PM	0	0	0	0	0	0	0	1	1	0	6	0	6	0	4	1	5	11	12
04:30 PM	0	0	0	0	0	1	0	1	1	0	3	0	3	0	2	1	3	6	7
04:45 PM	0	0	0	0	0	1	0	3	3	1	7	0	8	0	3	1	4	12	15
TOTAL	0	0	0	0	0	3	0	8	8	2	20	0	22	0	12	4	16	38	46
05:00 PM	0	0	0	0	0	0	0	1	1	1	6	0	7	0	3	4	7	14	15
05:15 PM	0	0	0	0	0	0	0	0	0	0	1	0	1	2	1	1	4	5	5
05:30 PM	0	1	0	0	0	1	0	3	4	0	0	0	0	0	1	2	3	3	7
05:45 PM	0	0	0	0	1	0	0	1	1	0	2	0	2	0	1	0	1	3	4
TOTAL	0	1	0	0	1	1	0	5	6	1	9	0	10	2	6	7	15	25	31

PM Peak																			
04:45 PM to 05:45 PM																			
0	1	0	0	1	5	0	2	0	7	8	2	14	0	0	2	8	0	18	42

4
N





LAKE COUNTY - TRAFFIC SIGNAL OPERATIONS

CARTEGRAPH ID: LC-S-047 **DATE: 05/09/2022**
INTERSECTION NAME AND ID: East Orange Ave & SR 44 091

PHASE	1	2	3	4	5	6	7	8
		WB		NB	WBL	EB		SB
INITIAL		15		8	5	15		8
PASSAGE		3		3	3	3		3
YELLOW		5.5		4.8	5.5	5.5		4.8
RED CLEAR		2.0		2.0	2.2	2.0		2.0
MAX 1		50		30	40	50		12
MAX 2								
WALK								
DON'T WALK								
RECALL		Min				Min		min
DET. FUNC.		L				L		

SYSTEM TIMING

PATTERN	CYCLE	OFFSET	COORDINATED		BASE DAY 1		BASE DAY 2	
	Sec	%	Phase	Sequence	Mon.-Fri.		Sat.-Sun.	
1	100	9	2	1	0:00	FREE	0:00	FREE
2	110	3	2	1	6:30	C1O1S1		
3	120	3	2	1	9:00	FREE		
					16:00	C2O2S2		
					17:00	C3O3S3		
					18:00	C2O2S2		
					19:00	FREE		

SPLIT ALLOCATION - %

PHASE	1	2	3	4	5	6	7	8
1		70		30	30	40		30
2		60		50	25	35		50
3		70		50	28	42		50

NOTES: NAZTEC

LAKE COUNTY - TRAFFIC SIGNAL OPERATIONS

CARTEGRAPH ID: MD-S-243 **DATE: 3/17/2022**
INTERSECTION NAME AND ID#: US 441 & Donnelly St **# 25**

PHASE	1	2	3	4	5	6	7	8
	SBL	NB	WBL	EB	NBL	SB	EBL	WB
INITIAL	5	17	5	8	5	17	5	8
PASSAGE	3	3	3	3	3	3	3	3
YELLOW	5.1	5.2	4.9	4.9	5.2	5.2	4.2	4.9
RED CLEAR	4.1	2.0	3.2	2.6	3.5	2.0	3.6	3.2
MAX 1	25	50	25	35	25	50	25	35
MAX 2								
WALK		7		7		7		7
DON'T WALK		34		37		31		36
RECALL		Min				Min		
DET. FUNC.		L				L		

SYSTEM TIMING

PATTERN	CYCLE	OFFSET	COORDINATED		BASE DAY 1		BASE DAY 2	
	Sec.	Sec.	Phase	Sequence	Mon.- Fri.		Saturday	
1(AM)	160	156	2	9	00:00	FREE	00:00	FREE
2(MIDDAY)	140	12	2	9	5:30	C1O1S1	8:00	C7O7S7
3(PM)	160	62	2	1	7:20	C5O5S5	10:30	C9O9S9
5(AM PK)	160	156	2	9	7:40	C15O15S15	15:30	C7O7S7
7(WKN)	150	107	2	9	7:55	C5O5S5	19:00	FREE
8(PM Pk)	160	61	2	1	8:15	C1O1S1	BASE DAY 3	
9(WKN PK)	160	90	2	9	9:00	C2O2S2	Sunday	
13	160	62	2	1	14:30	C3O3S3	00:00	FREE
15(AM PK)	160	156	2	9	15:15	C13O13S13	09:00	C7O7S7
					16:25	C3O3S3	19:00	FREE
					16:45	C8O8S8		
					18:00	C2O2S2		
					20:00	FREE		

SPLIT ALLOCATION - Sec.

PHASE	1	2	3	4	5	6	7	8
1(AM)	28	69	43	20	23	74	21	42
2(MIDDAY)	34	55	26	25	34	55	23	28
3(PM)	45	60	27	28	32	73	25	30
5(AM PK)	28	71	41	20	23	76	20	41
7(WKN)	36	61	28	25	30	67	20	33
8(PM Pk)	43	63	29	25	32	74	25	29
9(WKN PK)	38	65	30	27	32	71	22	35
13	38	67	27	28	32	73	25	30
15(AM PK)	28	61	41	20	23	66	20	51

NOTES:
 1. Offset referenced to end of main street green
 2. Use Fixed Force-offs
 3. Use Max inhibit during coordination
 4. Max Recall on phases 2 & 6
 5. Min Recall on phase 3 for patterns 1, 2, 5, 7, 9 & 15

LAKE COUNTY - TRAFFIC SIGNAL OPERATIONS

CARTEGRAPH ID: LC-S-496 **DATE: 05/09/2022**
INTERSECTION NAME AND ID: East Orange Ave & Estes Rd 496

PHASE	1	2	3	4	5	6	7	8
	EBL	WB				EB		SB
INITIAL	5	15				15		8
PASSAGE	3	3				3		4
YELLOW	4.8	4.8				4.8		3.3
RED CLEAR	2	2.2				2		3.2
MAX 1	15	50				50		20
MAX 2								
WALK								
DON'T WALK								
RECALL		Min				Min		
DET. FUNC.		L				L		

SYSTEM TIMING

PATTERN	CYCLE	OFFSET	COORDINATED		BASE DAY 1		BASE DAY 2	
	Sec	Sec	Phase	Sequence	Mon.-Fri.		Sat.-Sun.	
1	100	9	2	3	0:00	FREE	00:00	FREE
2	110	9	2	3	6:30	C1O1S1		
3	120	9	3	3	9:00	FREE		
					16:00	C2O2S2		
					17:00	C3O3S3		
					18:00	C2O2S2		
					19:00	FREE		

SPLIT ALLOCATION - %

PHASE	1	2	3	4	5	6	7	8
1	15	60		25		75		25
2	20	60		30		80		30
3	20	65		35		85		35

NOTES: NAZTEC

2022 PEAK SEASON FACTOR CATEGORY REPORT - REPORT TYPE: ALL
 CATEGORY: 1100 LAKE COUNTYWIDE

WEEK	DATES	SF	MOCF: 0.95 PSCF
1	01/01/2022 - 01/01/2022	0.99	1.04
2	01/02/2022 - 01/08/2022	1.01	1.06
3	01/09/2022 - 01/15/2022	1.03	1.08
4	01/16/2022 - 01/22/2022	1.02	1.07
5	01/23/2022 - 01/29/2022	1.00	1.05
* 6	01/30/2022 - 02/05/2022	0.98	1.03
* 7	02/06/2022 - 02/12/2022	0.97	1.02
* 8	02/13/2022 - 02/19/2022	0.95	1.00
* 9	02/20/2022 - 02/26/2022	0.95	1.00
*10	02/27/2022 - 03/05/2022	0.94	0.99
*11	03/06/2022 - 03/12/2022	0.94	0.99
*12	03/13/2022 - 03/19/2022	0.93	0.98
*13	03/20/2022 - 03/26/2022	0.94	0.99
*14	03/27/2022 - 04/02/2022	0.95	1.00
*15	04/03/2022 - 04/09/2022	0.95	1.00
*16	04/10/2022 - 04/16/2022	0.96	1.01
*17	04/17/2022 - 04/23/2022	0.97	1.02
*18	04/24/2022 - 04/30/2022	0.98	1.03
19	05/01/2022 - 05/07/2022	0.99	1.04
20	05/08/2022 - 05/14/2022	0.99	1.04
21	05/15/2022 - 05/21/2022	1.00	1.05
22	05/22/2022 - 05/28/2022	1.01	1.06
23	05/29/2022 - 06/04/2022	1.02	1.07
24	06/05/2022 - 06/11/2022	1.03	1.08
25	06/12/2022 - 06/18/2022	1.04	1.09
26	06/19/2022 - 06/25/2022	1.05	1.11
27	06/26/2022 - 07/02/2022	1.05	1.11
28	07/03/2022 - 07/09/2022	1.06	1.12
29	07/10/2022 - 07/16/2022	1.06	1.12
30	07/17/2022 - 07/23/2022	1.06	1.12
31	07/24/2022 - 07/30/2022	1.05	1.11
32	07/31/2022 - 08/06/2022	1.05	1.11
33	08/07/2022 - 08/13/2022	1.04	1.09
34	08/14/2022 - 08/20/2022	1.04	1.09
35	08/21/2022 - 08/27/2022	1.05	1.11
36	08/28/2022 - 09/03/2022	1.06	1.12
37	09/04/2022 - 09/10/2022	1.07	1.13
38	09/11/2022 - 09/17/2022	1.08	1.14
39	09/18/2022 - 09/24/2022	1.05	1.11
40	09/25/2022 - 10/01/2022	1.02	1.07
41	10/02/2022 - 10/08/2022	1.00	1.05
42	10/09/2022 - 10/15/2022	0.97	1.02
43	10/16/2022 - 10/22/2022	0.98	1.03
44	10/23/2022 - 10/29/2022	0.99	1.04
45	10/30/2022 - 11/05/2022	0.99	1.04
46	11/06/2022 - 11/12/2022	1.00	1.05
47	11/13/2022 - 11/19/2022	1.01	1.06
48	11/20/2022 - 11/26/2022	1.00	1.05
49	11/27/2022 - 12/03/2022	1.00	1.05
50	12/04/2022 - 12/10/2022	0.99	1.04
51	12/11/2022 - 12/17/2022	0.99	1.04
52	12/18/2022 - 12/24/2022	1.01	1.06
53	12/25/2022 - 12/31/2022	1.03	1.08

* PEAK SEASON

23-FEB-2023 09:11:22

830UPD

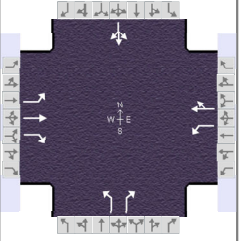
5_1100_PKSEASON.TXT

APPENDIX C

Existing HCS Capacity Analysis Sheets

HCS Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	TPD, Inc.			Duration, h	0.250		
Analyst	SS	Analysis Date	5/24/2023	Area Type	Other		
Jurisdiction	Lake County	Time Period	Existing PM	PHF	0.98		
Urban Street	Orange Ave	Analysis Year	2023	Analysis Period	1 > 17:00		
Intersection	SR 44	File Name	Orange Ave & SR 44 - Existing PM.xus				
Project Description	5802						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	0	362	249	308	419	1	426		463	0	0	0

Signal Information				Phase Diagrams								
Cycle, s	83.8	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	Yes	Simult. Gap E/W	On									
Force Mode	Fixed	Simult. Gap N/S	On									
Green	13.2	21.2	27.4	0.0	0.0	0.0						
Yellow	5.5	5.5	4.8	0.0	0.0	0.0						
Red	2.2	2.0	2.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		6	5	2		4		8
Case Number		5.3	1.0	4.0		9.0		12.0
Phase Duration, s		28.7	20.9	49.6		34.2		0.0
Change Period, (Y+R _c), s		7.5	7.7	7.5		6.8		6.8
Max Allow Headway (MAH), s		3.9	4.0	3.9		4.3		0.0
Queue Clearance Time (g _s), s		17.3	12.1	14.3		25.7		
Green Extension Time (g _e), s		3.9	1.1	3.9		1.7		0.0
Phase Call Probability		1.00	1.00	1.00		1.00		
Max Out Probability		0.00	0.00	0.00		0.99		

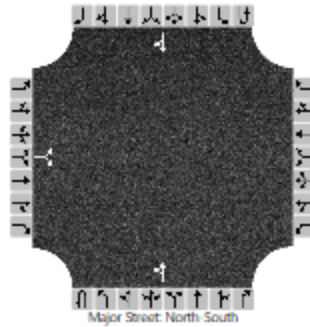
Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6	16	5	2	12	7		14	3	8	18
Adjusted Flow Rate (v), veh/h	0	369	254	314	429		435		472		0	
Adjusted Saturation Flow Rate (s), veh/h/ln	974	1885	1598	1795	1884		1795		1598		0	
Queue Service Time (g _s), s	0.0	15.3	11.9	10.1	12.3		18.0		23.7		0.0	
Cycle Queue Clearance Time (g _c), s	0.0	15.3	11.9	10.1	12.3		18.0		23.7		0.0	
Green Ratio (g/C)	0.25	0.25	0.25	0.43	0.50		0.33		0.33			
Capacity (c), veh/h	86	478	405	441	946		588		523			
Volume-to-Capacity Ratio (X)	0.000	0.773	0.627	0.713	0.453		0.739		0.903		0.000	
Back of Queue (Q), ft/ln (95 th percentile)												
Back of Queue (Q), veh/ln (95 th percentile)	0.0	10.7	7.6	6.9	7.9		12.5		16.3		0.0	
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00	
Uniform Delay (d ₁), s/veh	0.0	29.1	27.8	18.8	13.5		25.1		27.0			
Incremental Delay (d ₂), s/veh	0.0	2.7	1.6	2.2	0.3		4.2		16.9		0.0	
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0	0.0	0.0		0.0		0.0		0.0	
Control Delay (d), s/veh	0.0	31.8	29.4	21.0	13.8		29.2		43.9			
Level of Service (LOS)		C	C	C	B		C		D			
Approach Delay, s/veh / LOS	30.8		C	16.8		B	36.8		D	0.0		
Intersection Delay, s/veh / LOS	28.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.92	B	1.67	B	1.95	B	2.14	B
Bicycle LOS Score / LOS	1.52	B	1.71	B		F	0.49	A

HCS Two-Way Stop-Control Report

General Information				Site Information			
Analyst	SS			Intersection	SR 44 & Lake Joanna Dr		
Agency/Co.	TPD, Inc.			Jurisdiction	Lake County		
Date Performed	5/24/2023			East/West Street	Lake Joanna Dr		
Analysis Year	2023			North/South Street	SR 44		
Time Analyzed	Existing PM			Peak Hour Factor	0.86		
Intersection Orientation	North-South			Analysis Time Period (hrs)	0.25		
Project Description	5802						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound				
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	
Movement																	
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6	
Number of Lanes		0	1	0		0	0	0		0	1	0		0	1	0	
Configuration			LR							LT						TR	
Volume (veh/h)		7		9						4	949				581	8	
Percent Heavy Vehicles (%)		0		0						0							
Proportion Time Blocked																	
Percent Grade (%)		0															
Right Turn Channelized																	
Median Type Storage		Undivided															

Critical and Follow-up Headways

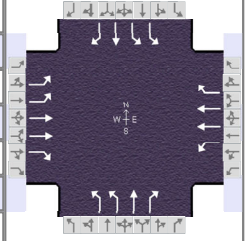
Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.40		6.20						4.10						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.50		3.30						2.20						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			19							5								
Capacity, c (veh/h)			162							918								
v/c Ratio			0.11							0.01								
95% Queue Length, Q ₉₅ (veh)			0.4							0.0								
Control Delay (s/veh)			30.1							8.9	0.1							
Level of Service (LOS)			D							A	A							
Approach Delay (s/veh)		30.1									0.2							
Approach LOS		D									A							

HCS Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	TPD, Inc.			Duration, h	0.250		
Analyst	SS	Analysis Date	5/24/2023	Area Type	Other		
Jurisdiction	Lake County	Time Period	Existing PM	PHF	0.94		
Urban Street	US 441	Analysis Year	2023	Analysis Period	1 > 17:00		
Intersection	SR 44/Donnelly St	File Name	US 441 & SR 44 - Existing PM.xus				
Project Description	5802						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	575	1209	124	158	986	492	220	291	56	370	225	277

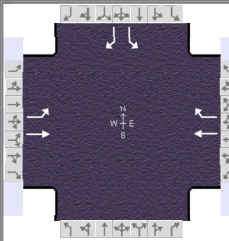
Signal Information													
Cycle, s	160.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	On	Green	13.1	8.4	68.5	16.9	21.5	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.2	0.0	5.2	4.9	4.9	0.0			
				Red	3.5	0.0	2.0	3.2	2.6	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	25.0	29.0	25.0	29.0	21.8	75.7	30.3	84.2
Change Period, (Y+R _c), s	7.8	8.1	8.1	8.1	8.7	7.2	9.2	7.2
Max Allow Headway (MAH), s	4.0	4.0	4.0	4.0	4.1	0.0	4.1	0.0
Queue Clearance Time (g _s), s	19.2	22.9	16.8	22.9	12.5		19.7	
Green Extension Time (g _e), s	0.0	0.0	0.2	0.0	0.7	0.0	1.4	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	0.92	1.00	0.01		0.01	

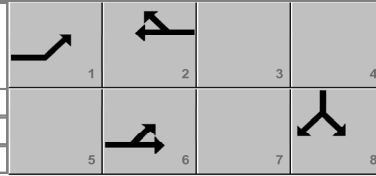
Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	612	1286	132	168	1049	523	234	310	60	394	239	295
Adjusted Saturation Flow Rate (s), veh/h/ln	1757	1795	1610	1795	1795	1585	1757	1900	1610	1743	1900	1598
Queue Service Time (g _s), s	17.2	20.9	12.4	14.8	20.9	20.9	10.5	17.8	3.5	17.7	12.0	18.8
Cycle Queue Clearance Time (g _c), s	17.2	20.9	12.4	14.8	20.9	20.9	10.5	17.8	3.5	17.7	12.0	18.8
Green Ratio (g/C)	0.11	0.13	0.13	0.11	0.13	0.13	0.08	0.43	0.43	0.13	0.48	0.48
Capacity (c), veh/h	378	468	210	190	469	207	288	814	690	459	914	768
Volume-to-Capacity Ratio (X)	1.619	2.749	0.628	0.884	2.237	2.528	0.811	0.380	0.086	0.857	0.262	0.383
Back of Queue (Q), ft/ln (95 th percentile)												
Back of Queue (Q), veh/ln (95 th percentile)	36.0	94.2	9.2	12.8	71.9	76.2	8.6	13.3	2.6	13.0	9.5	12.0
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d ₁), s/veh	71.4	69.6	65.9	70.6	69.6	69.6	72.2	31.2	27.2	68.0	24.7	26.4
Incremental Delay (d ₂), s/veh	290.6	792.9	5.8	26.6	563.6	701.7	5.4	1.4	0.2	5.8	0.7	1.4
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	362.0	862.5	71.7	97.2	633.1	771.2	77.7	32.6	27.4	73.8	25.3	27.9
Level of Service (LOS)	F	F	E	F	F	F	E	C	C	E	C	C
Approach Delay, s/veh / LOS	660.3	F		622.9	F		49.6	D		46.7	D	
Intersection Delay, s/veh / LOS	471.1						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.32	B	2.47	B	2.44	B	2.57	C
Bicycle LOS Score / LOS	2.16	B	1.92	B	1.48	A	2.02	B

HCS Signalized Intersection Results Summary

General Information				Intersection Information		
Agency	TPD, Inc.			Duration, h	0.250	
Analyst	SS	Analysis Date	5/24/2023	Area Type	Other	
Jurisdiction	Lake County	Time Period	Existing PM	PHF	0.97	
Urban Street	Orange Ave	Analysis Year	2023	Analysis Period	1 > 17:00	
Intersection	Estes Rd	File Name	Estes Rd & Orange Ave - Existing PM.xus			
Project Description	5802					

Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	24	492			638	202				110		29

Signal Information													
Cycle, s	52.2	Reference Phase	2										
Offset, s	0	Reference Point	End	Green	1.5	23.4	7.0	0.0	0.0	0.0			
Uncoordinated	Yes	Simult. Gap E/W	On	Yellow	4.8	4.8	3.3	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	2.2	3.2	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2				8
Case Number	1.0	4.0		7.3				9.0
Phase Duration, s	8.3	38.7		30.4				13.5
Change Period, ($Y+R_c$), s	6.8	7.0		7.0				6.5
Max Allow Headway (MAH), s	4.0	3.9		3.9				5.0
Queue Clearance Time (g_s), s	2.4	9.5		17.6				5.1
Green Extension Time (g_e), s	0.0	5.9		5.8				0.5
Phase Call Probability	0.30	1.00		1.00				0.88
Max Out Probability	0.00	0.01		0.02				0.00

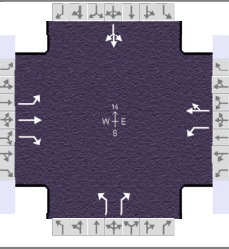
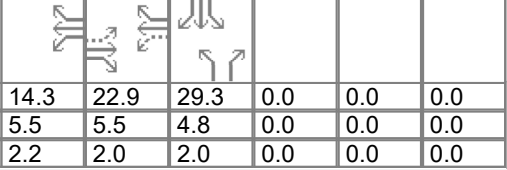
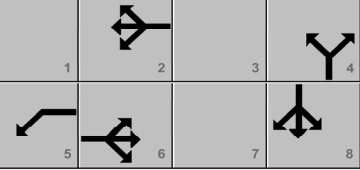
Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6			2	12				3		18
Adjusted Flow Rate (v), veh/h	25	507			658	208				113		30
Adjusted Saturation Flow Rate (s), veh/h/ln	1810	1885			1870	1610				1781		1610
Queue Service Time (g_s), s	0.4	7.5			15.6	4.3				3.1		0.9
Cycle Queue Clearance Time (g_c), s	0.4	7.5			15.6	4.3				3.1		0.9
Green Ratio (g/C)	0.48	0.61			0.45	0.45				0.13		0.13
Capacity (c), veh/h	308	1145			839	722				239		216
Volume-to-Capacity Ratio (X)	0.080	0.443			0.784	0.288				0.475		0.138
Back of Queue (Q), ft/ln (95 th percentile)												
Back of Queue (Q), veh/ln (95 th percentile)	0.2	2.5			8.2	1.9				2.2		0.5
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (d_1), s/veh	9.6	5.5			12.3	9.1				20.9		20.0
Incremental Delay (d_2), s/veh	0.1	0.3			1.7	0.2				2.1		0.4
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (d), s/veh	9.7	5.8			13.9	9.3				23.0		20.4
Level of Service (LOS)	A	A			B	A				C		C
Approach Delay, s/veh / LOS	6.0		A	12.8		B	0.0			22.4		C
Intersection Delay, s/veh / LOS	11.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.65	A	1.88	B	1.93	B	1.93	B
Bicycle LOS Score / LOS	1.37	A	1.92	B				F

APPENDIX D

Projected HCS Capacity Analysis Worksheets

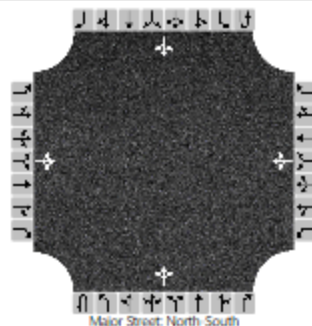
HCS Signalized Intersection Results Summary

General Information					Intersection Information											
Agency	TPD, Inc.				Duration, h	0.250										
Analyst	SS		Analysis Date	5/24/2023		Area Type	Other									
Jurisdiction	Lake County		Time Period	Projected PM		PHF	0.98									
Urban Street	Orange Ave		Analysis Year	2025		Analysis Period	1 > 17:00									
Intersection	SR 44		File Name	Orange Ave & SR 44 - Projected PM.xus												
Project Description	5802															
Demand Information					EB			WB			NB			SB		
Approach Movement					L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h					0	376	268	324	436	1	449		485	0	0	0
Signal Information																
Cycle, s	88.5	Reference Phase	2													
Offset, s	0	Reference Point	End													
Uncoordinated	Yes	Simult. Gap E/W	On													
Force Mode	Fixed	Simult. Gap N/S	On		Green	14.3	22.9	29.3	0.0	0.0	0.0					
		Yellow	5.5	5.5	4.8	0.0	0.0	0.0								
		Red	2.2	2.0	2.0	0.0	0.0	0.0								
Timer Results					EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Assigned Phase						6	5	2		4		8				
Case Number						5.3	1.0	4.0		9.0		12.0				
Phase Duration, s						30.4	22.0	52.4		36.1		0.0				
Change Period, (Y+R _c), s						7.5	7.7	7.5		6.8		6.8				
Max Allow Headway (MAH), s						3.9	4.0	3.9		4.3		0.0				
Queue Clearance Time (g _s), s						18.8	13.1	15.5		28.6						
Green Extension Time (g _e), s						4.1	1.1	4.2		0.7		0.0				
Phase Call Probability						1.00	1.00	1.00		1.00						
Max Out Probability						0.01	0.00	0.00		1.00						
Movement Group Results					EB			WB			NB			SB		
Approach Movement					L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement					1	6	16	5	2	12	7		14	3	8	18
Adjusted Flow Rate (v), veh/h					0	384	273	331	446		458		495		0	
Adjusted Saturation Flow Rate (s), veh/h/ln					959	1885	1598	1795	1884		1795		1598		0	
Queue Service Time (g _s), s					0.0	16.8	13.6	11.1	13.5		20.3		26.6		0.0	
Cycle Queue Clearance Time (g _c), s					0.0	16.8	13.6	11.1	13.5		20.3		26.6		0.0	
Green Ratio (g/C)					0.26	0.26	0.26	0.44	0.51		0.33		0.33			
Capacity (c), veh/h					81	489	414	441	956		594		529			
Volume-to-Capacity Ratio (X)					0.000	0.785	0.660	0.749	0.466		0.771		0.936		0.000	
Back of Queue (Q), ft/ln (95 th percentile)																
Back of Queue (Q), veh/ln (95 th percentile)					0.0	11.6	8.5	7.7	8.6		14.2		19.0		0.0	
Queue Storage Ratio (RQ) (95 th percentile)					0.00	0.00	0.00	0.00	0.00		0.00		0.00		0.00	
Uniform Delay (d ₁), s/veh					0.0	30.5	29.3	19.7	14.1		26.6		28.7			
Incremental Delay (d ₂), s/veh					0.0	2.8	1.8	2.6	0.4		5.9		23.6		0.0	
Initial Queue Delay (d ₃), s/veh					0.0	0.0	0.0	0.0	0.0		0.0		0.0		0.0	
Control Delay (d), s/veh					0.0	33.3	31.1	22.3	14.4		32.5		52.3			
Level of Service (LOS)						C	C	C	B		C		D			
Approach Delay, s/veh / LOS					32.4		C	17.8		B	42.8		D	0.0		
Intersection Delay, s/veh / LOS					31.8					C						
Multimodal Results					EB			WB			NB			SB		
Pedestrian LOS Score / LOS					1.93		B	1.67		B	1.95		B	2.14		B
Bicycle LOS Score / LOS					1.57		B	1.77		B			F	0.49	A	

HCS Two-Way Stop-Control Report

General Information				Site Information			
Analyst	SS			Intersection	SR 44 & Lake Joanna Dr/Site Access		
Agency/Co.	TPD, Inc.			Jurisdiction	Lake County		
Date Performed	5/24/2023			East/West Street	Lake Joanna Dr/Site Access		
Analysis Year	2025			North/South Street	SR 44		
Time Analyzed	Projected PM			Peak Hour Factor	0.86		
Intersection Orientation	North-South			Analysis Time Period (hrs)	0.25		
Project Description	5802						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound				
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	
Movement																	
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6	
Number of Lanes		0	1	0		0	1	0		0	1	0		0	1	0	
Configuration			LTR				LTR				LTR				LTR		
Volume (veh/h)		7	0	9		17	0	9		4	987	26		14	604	8	
Percent Heavy Vehicles (%)		0	3	0		3	3	3		0				3			
Proportion Time Blocked																	
Percent Grade (%)		0				0											
Right Turn Channelized																	
Median Type Storage		Undivided															

Critical and Follow-up Headways

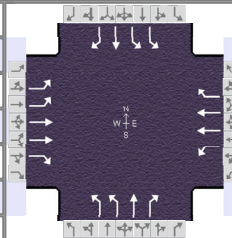
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.10	6.53	6.20		7.13	6.53	6.23		4.10				4.13		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.50	4.03	3.30		3.53	4.03	3.33		2.20				2.23		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			19				30			5				16			
Capacity, c (veh/h)			96				65			897				589			
v/c Ratio			0.19				0.46			0.01				0.03			
95% Queue Length, Q ₉₅ (veh)			0.7				1.8			0.0				0.1			
Control Delay (s/veh)			51.1				100.4			9.0	0.1	0.1		11.3	0.5	0.5	
Level of Service (LOS)			F				F			A	A	A		B	A	A	
Approach Delay (s/veh)		51.1				100.4				0.2				0.8			
Approach LOS		F				F				A				A			

HCS Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	TPD, Inc.			Duration, h	0.250		
Analyst	SS	Analysis Date	5/24/2023	Area Type	Other		
Jurisdiction	Lake County	Time Period	Projected PM	PHF	0.94		
Urban Street	US 441	Analysis Year	2025	Analysis Period	1 > 17:00		
Intersection	SR 44/Donnelly St	File Name	US 441 & SR 44 - Projected PM.xus				
Project Description	5802						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	606	1257	129	164	1025	521	229	308	58	391	237	293

Signal Information													
Cycle, s	160.0	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	No	Simult. Gap E/W	On	Green	13.6	9.0	67.5	17.2	0.6	20.9			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.2	0.0	5.2	4.2	0.0	4.9			
				Red	3.5	0.0	2.0	3.6	0.0	2.6			

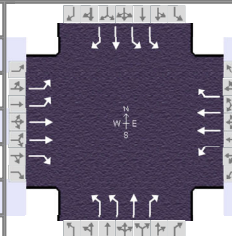
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	25.0	28.4	25.6	29.0	22.3	74.7	31.3	83.7
Change Period, (Y+R _c), s	7.8	8.1	8.1	8.1	8.7	7.2	9.2	7.2
Max Allow Headway (MAH), s	4.0	4.0	4.0	4.0	4.1	0.0	4.1	0.0
Queue Clearance Time (g _s), s	19.2	22.3	17.3	22.9	12.9		20.7	
Green Extension Time (g _e), s	0.0	0.0	0.2	0.0	0.7	0.0	1.5	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	1.00	1.00	1.00	0.01		0.01	

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	645	1337	137	174	1090	554	244	328	62	416	252	312
Adjusted Saturation Flow Rate (s), veh/h/ln	1757	1795	1610	1795	1795	1585	1757	1900	1610	1743	1900	1598
Queue Service Time (g _s), s	17.2	20.3	13.0	15.3	20.9	20.9	10.9	19.3	3.7	18.7	12.8	20.2
Cycle Queue Clearance Time (g _c), s	17.2	20.3	13.0	15.3	20.9	20.9	10.9	19.3	3.7	18.7	12.8	20.2
Green Ratio (g/C)	0.11	0.13	0.13	0.11	0.13	0.13	0.08	0.42	0.42	0.14	0.48	0.48
Capacity (c), veh/h	378	456	204	196	469	207	298	801	679	482	909	764
Volume-to-Capacity Ratio (X)	1.707	2.936	0.672	0.889	2.326	2.677	0.817	0.409	0.091	0.862	0.277	0.408
Back of Queue (Q), ft/ln (95 th percentile)												
Back of Queue (Q), veh/ln (95 th percentile)	39.2	99.5	9.7	13.3	75.8	81.9	8.9	14.3	2.7	13.6	10.1	12.8
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d ₁), s/veh	71.4	69.8	66.7	70.3	69.6	69.6	72.0	32.3	27.8	67.4	25.1	27.1
Incremental Delay (d ₂), s/veh	329.1	876.9	8.3	28.1	603.2	768.3	5.4	1.5	0.3	6.7	0.8	1.6
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	400.5	946.8	74.9	98.4	672.8	837.8	77.4	33.9	28.1	74.2	25.9	28.7
Level of Service (LOS)	F	F	E	F	F	F	E	C	C	E	C	C
Approach Delay, s/veh / LOS	724.1		F	668.0		F	50.1		D	47.3		D
Intersection Delay, s/veh / LOS	509.4						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.32	B	2.47	B	2.44	B	2.57	C
Bicycle LOS Score / LOS	2.24	B	1.99	B	1.53	B	2.10	B

HCS Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	TPD, Inc.			Duration, h	0.250		
Analyst	SS	Analysis Date	5/24/2023	Area Type	Other		
Jurisdiction	Lake County	Time Period	Projected PM	PHF	0.94		
Urban Street	US 441	Analysis Year	2025	Analysis Period	1 > 17:00		
Intersection	SR 44/Donnelly St	File Name	US 441 & SR 44 - Projected PM Optimized.xus				
Project Description	5802 - Optimized Signal Timings						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	606	1257	129	164	1025	521	229	308	58	391	237	293

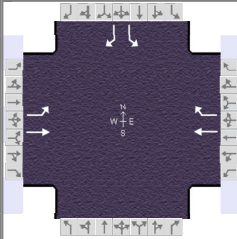
Signal Information				Signal Phases											
Cycle, s	160.0	Reference Phase	2	↙	↘	↕	↕	↗	↖	↙	↘	↕	↕	↗	↖
Offset, s	0	Reference Point	End	↙	↘	↕	↕	↗	↖	↙	↘	↕	↕	↗	↖
Uncoordinated	No	Simult. Gap E/W	On	Green	13.5	8.6	23.0	17.8	4.3	52.9					
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.2	0.0	5.2	4.9	4.2	4.9					
				Red	3.5	0.0	2.0	3.2	3.6	3.2					

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	7	4	3	8	5	2	1	6
Case Number	2.0	3.0	2.0	3.0	2.0	3.0	2.0	3.0
Phase Duration, s	38.0	73.1	25.9	61.0	22.2	30.2	30.8	38.8
Change Period, (Y+R _c), s	7.8	8.1	8.1	8.1	8.7	7.2	9.2	7.2
Max Allow Headway (MAH), s	4.0	4.0	4.0	4.0	4.1	0.0	4.1	0.0
Queue Clearance Time (g _s), s	31.2	58.4	17.3	54.9	12.9		20.8	
Green Extension Time (g _e), s	0.0	5.7	0.5	0.0	0.6	0.0	0.8	0.0
Phase Call Probability	1.00	1.00	1.00	1.00	1.00		1.00	
Max Out Probability	1.00	0.94	0.00	1.00	0.05		0.64	

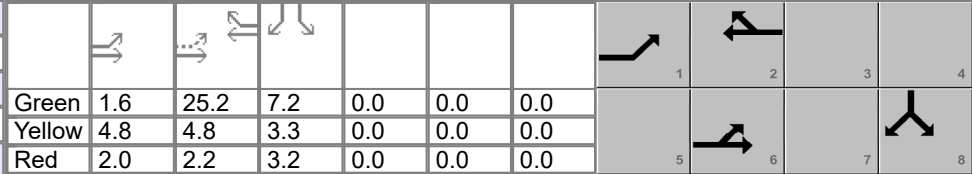
Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	645	1337	137	174	1090	554	244	328	62	416	252	312
Adjusted Saturation Flow Rate (s), veh/h/ln	1757	1795	1610	1795	1795	1585	1757	1900	1610	1743	1900	1598
Queue Service Time (g _s), s	29.2	56.4	8.9	15.3	46.7	52.9	10.9	23.0	5.5	18.8	19.6	31.1
Cycle Queue Clearance Time (g _c), s	29.2	56.4	8.9	15.3	46.7	52.9	10.9	23.0	5.5	18.8	19.6	31.1
Green Ratio (g/C)	0.19	0.41	0.41	0.11	0.33	0.33	0.08	0.14	0.14	0.13	0.20	0.20
Capacity (c), veh/h	663	1458	654	200	1187	524	297	273	232	470	375	315
Volume-to-Capacity Ratio (X)	0.972	0.917	0.210	0.873	0.919	1.058	0.821	1.198	0.266	0.885	0.672	0.988
Back of Queue (Q), ft/ln (95 th percentile)												
Back of Queue (Q), veh/ln (95 th percentile)	21.8	34.7	6.2	12.1	30.1	38.8	8.9	29.9	4.4	14.2	15.7	23.5
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Uniform Delay (d ₁), s/veh	64.5	45.0	30.8	70.0	51.5	53.6	72.1	68.5	61.0	68.0	59.4	64.0
Incremental Delay (d ₂), s/veh	28.0	9.5	0.2	11.2	11.4	55.4	6.4	119.1	2.8	13.8	9.2	47.7
Initial Queue Delay (d ₃), s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh	92.4	54.5	31.0	81.1	62.9	109.0	78.5	187.6	63.8	81.7	68.7	111.8
Level of Service (LOS)	F	D	C	F	E	F	E	F	E	F	E	F
Approach Delay, s/veh / LOS	64.5		E	78.7		E	133.5		F	87.9		F
Intersection Delay, s/veh / LOS	81.2						F					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.29	B	2.45	B	2.47	B	2.61	C
Bicycle LOS Score / LOS	2.24	B	1.99	B	1.53	B	2.10	B

HCS Signalized Intersection Results Summary

General Information				Intersection Information		
Agency	TPD, Inc.			Duration, h	0.250	
Analyst	SS	Analysis Date	5/24/2023	Area Type	Other	
Jurisdiction	Lake County	Time Period	Projected PM	PHF	0.97	
Urban Street	Orange Ave	Analysis Year	2025	Analysis Period	1 > 17:00	
Intersection	Estes Rd	File Name	Estes Rd & Orange Ave - Projected PM.xus			
Project Description	5802					

Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	25	519			669	211				118		31

Signal Information														
Cycle, s	54.3	Reference Phase	2	Green	1.6	25.2	7.2	0.0	0.0	0.0				
Offset, s	0	Reference Point	End	Yellow	4.8	4.8	3.3	0.0	0.0	0.0				
Uncoordinated	Yes	Simult. Gap E/W	On	Red	2.0	2.2	3.2	0.0	0.0	0.0				
Force Mode	Fixed	Simult. Gap N/S	On											

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	1	6		2				8
Case Number	1.0	4.0		7.3				9.0
Phase Duration, s	8.4	40.6		32.2				13.7
Change Period, (Y+R _c), s	6.8	7.0		7.0				6.5
Max Allow Headway (MAH), s	4.0	3.9		3.9				5.0
Queue Clearance Time (g _s), s	2.4	10.2		19.0				5.5
Green Extension Time (g _e), s	0.0	6.3		6.2				0.6
Phase Call Probability	0.32	1.00		1.00				0.90
Max Out Probability	0.00	0.01		0.03				0.00

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	1	6			2	12				3		18
Adjusted Flow Rate (v), veh/h	26	535			690	218				122		32
Adjusted Saturation Flow Rate (s), veh/h/ln	1810	1885			1870	1610				1781		1610
Queue Service Time (g _s), s	0.4	8.2			17.0	4.6				3.5		1.0
Cycle Queue Clearance Time (g _c), s	0.4	8.2			17.0	4.6				3.5		1.0
Green Ratio (g/C)	0.49	0.62			0.46	0.46				0.13		0.13
Capacity (c), veh/h	302	1167			868	747				237		214
Volume-to-Capacity Ratio (X)	0.085	0.459			0.795	0.291				0.514		0.149
Back of Queue (Q), ft/ln (95 th percentile)												
Back of Queue (Q), veh/ln (95 th percentile)	0.2	2.8			8.8	2.0				2.5		0.6
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (d ₁), s/veh	9.8	5.5			12.4	9.0				21.9		20.9
Incremental Delay (d ₂), s/veh	0.1	0.3			1.7	0.2				2.5		0.5
Initial Queue Delay (d ₃), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (d), s/veh	9.9	5.8			14.1	9.2				24.4		21.3
Level of Service (LOS)	A	A			B	A				C		C
Approach Delay, s/veh / LOS	6.0	A		12.9	B		0.0			23.7		C
Intersection Delay, s/veh / LOS	11.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.65	A	1.88	B	1.93	B	1.93	B
Bicycle LOS Score / LOS	1.41	A	1.98	B				F

APPENDIX E

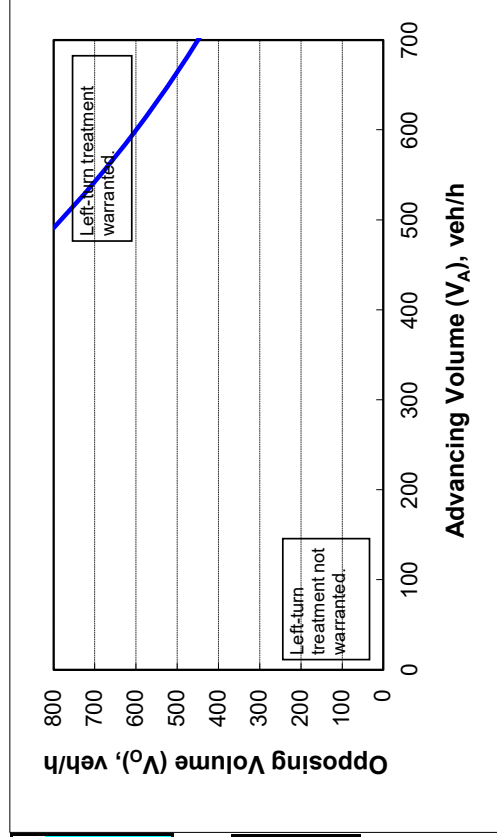
Turn Lane Referenced Data

Figure 2 - 5. Guideline for determining the need for a major-road left-turn bay at a two-way stop-controlled intersection.

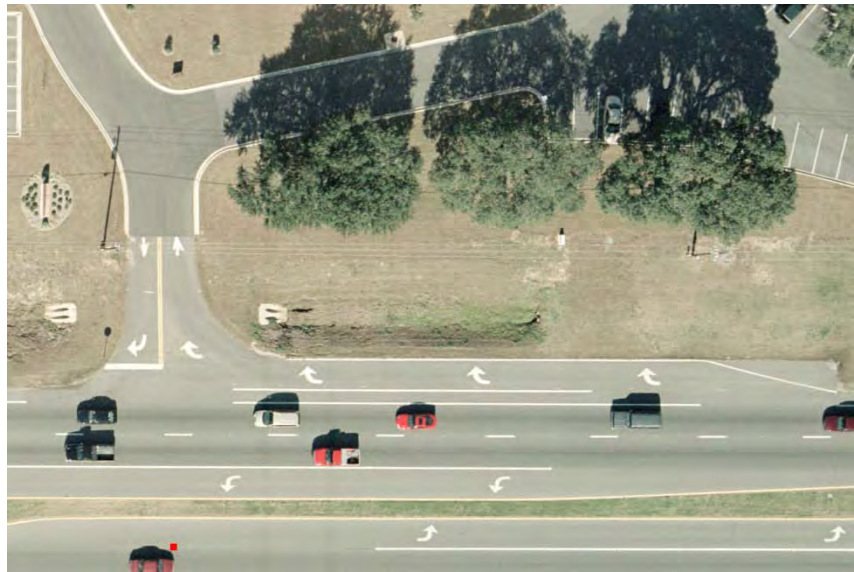
2-lane roadway (English)

INPUT	
Variable	Value
85 th percentile speed, mph:	45
Percent of left-turns in advancing volume (V_A), %:	2%
Advancing volume (V_A), veh/h:	626
Opposing volume (V_O), veh/h:	1017

OUTPUT	
Variable	Value
Limiting advancing volume (V_A), veh/h:	398
Guidance for determining the need for a major-road left-turn bay:	
Left-turn treatment warranted.	



CALIBRATION CONSTANTS	
Variable	Value
Average time for making left-turn, s:	3.0
Critical headway, s:	5.0
Average time for left-turn vehicle to clear the advancing lane, s:	1.9



RIGHT TURN LANES

7.1

EXCLUSIVE RIGHT
TURN LANES AT
UNSIGNALIZED
DRIVEWAYS

Exclusive right turn lanes are useful where a combination of high roadway speeds, and high right turn volumes into a driveway are expected. Congestion on the roadway may also be a good reason to use an exclusive right turn lane. If properly built, they remove the turning vehicle from the through lanes, thereby decreasing the operational impact of right turn vehicles on the through traffic.

The ***Standard Index*** has no specific guidance on warrants for right turn lanes into unsignalized driveways. The guidelines in this chapter were developed to assist in the decision-making process. However, *Standard Index 301* contains the standards necessary for the design of right turn lanes. The picture in Index 301 shows a left turn lane, but the design features are the same, except for the fact that queues would not usually be present on unsignalized driveways.

7.2

WHEN SHOULD WE BUILD RIGHT TURN LANES?

Exhibit 44
Recommended Guidelines
for Exclusive Right Turn
Lanes to Unsignalized*
Driveway

Roadway Posted Speed Limit	Number of Right Turns Per Hour
45 mph or less	80-125 (see note 1)
Over 45 mph	35-55 (see note 2)

*May not be appropriate for signalized locations where signal phasing plays an important role in determining the need for right turn lanes.

1. The lower threshold of 80 right turn vehicles per hour would be most used for higher volume (greater than 600 vehicles per hour, per lane in one direction on the major roadway) or two-lane roads where lateral movement is restricted. The 125 right turn vehicles per hour upper threshold would be most appropriate on lower volume roadways, multilane highways, or driveways with a large entry radius (50 feet or greater).
2. The lower threshold of 35 right turn vehicles per hour would be most appropriately used on higher volume two-lane roadways where lateral movement is restricted. The 55 right turn vehicles per hour upper threshold would be most appropriate on lower volume roadways, multilane highways, or driveways with large entry radius (50 feet or greater).

Note: A posted speed limit of 45 mph may be used with these thresholds if the operating speeds are known to be over 45 mph during the time of peak right turn demand.

Note on Traffic projections: Projecting turning volumes is, at best, a knowledgeable estimate. Keep this in mind especially if the projections of right turns are close to meeting the guidelines. In that case, consider requiring the turn lane.

Where The Right Turn Lane Guidelines Came From

These recommendations are primarily based on the research done in ***NCHRP Report 420, Impacts of Access Management Techniques***, Chapter 4 – Unsignalized Access Spacing (Technique 1B), and *Use of Speed Differential as a Measure To Evaluate the Need for Right-Turn Deceleration Lane at Unsignalized Intersections*, by Jan Thakkar, P.E., and Mohammed A. Hadi, Ph.D., P.E.

In the ***NCHRP Report 420***, the observed high-speed roads, 30 to 40 right turn vehicles per hour caused evasive maneuvers on 5 to 10 percent of the following through vehicles. For lower speed roadways, 80 to 110 right turn vehicles caused 15 to 20 percent of the following through vehicles to make evasive maneuvers. The choice of acceptable percentages of through vehicles impacted is a decision based on reasonable expectations of the different roadways.

In the Thakkar-Hadi study, by modeling speed differentials, a better understanding of the impacts of through volume and driveway radius was discovered.

7.3

IMPACT OF LARGE AND SLOW MOVING VEHICLES TURNING RIGHT



Speed and the volume of right turns should not be the only criteria used to determine the requirement for an exclusive right turn lane at unsignalized intersections. In order to minimize the rear-end collision potential of some situations, a right turn lane may be required where large and slow moving vehicles need to turn right such as;

- Trucking facilities (or locations that have a high volume of large vehicle traffic such as water ports, train stations, etc.)
- Recreational facilities attracting boats, trailers and other large recreation vehicles
- Transit facilities
- Schools